ACTA NRO. 1

PREGUNTAS Y RESPUESTAS

PROCESO: AE-001-2020-EP-CONST

CONCUSO PÚBLICO PARA: "IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y DE ASEO DE SANTO DOMINGO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO"

En la ciudad de Santo Domingo, Provincia de Santo Domingo de los Tsáchilas, a las 09h00 horas del 21 de diciembre del 2020, conforme al Artículo 18 del REGLAMENTO DE ASOCIATIVIDAD DE LA EP-CONST, el numeral 11.1. Preguntas y Aclaraciones del Pliego; y el Memorando No. EP-CONST-GG-2020-0514-M de 11 de diciembre de 2020, se reúnen los miembros de la Comisión Técnica designada y conformada por:

- Profesional designado por la Máxima Autoridad: Ing. Mauro Paúl Viñan Andino, quien presidirá la Comisión (con voz y voto)
- Titular de área: Mv. Ider David Alcívar Angueta, Director de Saneamiento y Gestión Ambiental (con voz y voto)
- Profesional relacionado con el proceso: Ing. Pedro Fernando Calderón Reascos (con voz y voto)
- Procuradora Síndica: Abg. Marian Carolina Cadena Sarmiento (solo voz informativa)
- Secretaria del Proceso: Ing. Stephanie Tamara Sandoval Yanchaliquín, funcionaria de la Jefatura de Contratación Pública, en lo referente a la redacción de la presente acta. (sin voz y sin voto)
- Lic. Eliana Isabel Durán Granda, Directora Financiera quien intervendrá con voz informativa para la fase de la evaluación financiera.

El Presidente de la Comisión Especial, propone el siguiente orden del día:

1. Constatación del Quórum Reglamentario.
2. Reunión de la Audiencia Informativa de aclaraciones y respuestas del proceso de selección.
3. Clausura

Autorizado el mismo por los comparecientes, se procede al desarrollo de la Sesión:

1.- Constatación del Quórum Reglamentario.

Toma la palabra el Ing. Mauro Viñan – Delegado de la máxima autoridad, Presidente de la Comisión, y confirmada la presencia de todos los miembros designados.

Conforme el Memorando EP-CONST-GG-2020-0514-M, de fecha 11 de diciembre de 2020 y Pliegos del presente proceso, se determina que existe el quórum reglamentario por lo que declara instalada la sesión. Se procede con la lectura del orden del día en el cual es aprobado por unanimidad y se procede con los siguientes temas a tratar.

Se deja constancia que la Ab. Marian Carolina Cadena Sarmiento, actúa únicamente con voz en los asuntos netamente legales sin adentrarse a los aspectos técnicos, por cuanto no es de su competencia.

2.- Reunión de Audiencia Informativa de aclaraciones y respuesta del proceso de selección. -

El Presidente dispone que, por secretaría, se de lectura de la publicación efectuada días anteriores con motivo del inicio del presente proceso de selección de Aliado Estratégico, de lo cual se despende el siguiente cronograma del proceso:

FASE	**CONCEPTO**	**FECHA - DIA**
Preparación de Ofertas	Publicación de la Convocatoria por la prensa escrita y medios digitales (www.epp.gob.ec)	16/12/2020
	Recepción de Preguntas	18-12-2020 (Hasta las 17H00)
	Respuestas y Aclaraciones	21/12/2020
	Límite de Entrega de Ofertas	30/12/2020
Calificación de Oferentes	Apertura de Ofertas	30/12/2020
	Solicitud de Convalidación	5/1/2021
	Entrega de Convalidación	8/1/2021
	Calificación y Presentación de Informe e Invitación a Negociar	13/1/2021
Negociación y Adjudicación	Inicio de Negociación Técnica Económica y Contractual	15/1/2021
	Suscripción del Acta de Negociación	15/1/2021
	Fecha Aproximada de Adjudicación	18/1/2021

El presidente de la Comisión Técnica, solicita a la Secretaria del Proceso por haber terminado el período de Recepción de Preguntas, proceda con la lectura del Memorando No. EP-CONST-GG-2020-0525-M de 21 de diciembre de 2020, el cual contiene los correos recibidos en la cuenta aliados.estrategicos@epconst.gob.ec, los cuales también contienen las preguntas realizadas a través del formulario de preguntas ubicado en la parte inferior de la página de la EP-CONST, dispuesto en los pliegos y convocatoria para la recepción de preguntas de los interesados dentro del proceso.

El Presidente, pone en conocimiento de los miembros de la Comisión las preguntas presentadas, y dispone se instale la reunión para proceder a la respuesta de las mismas en el orden establecido en los correos recibidos.

3. PREGUNTAS Y RESPUESTAS

Se procede a transcribir literalmente el contenido de las preguntas en el orden cronológico de presentación y en el mismo orden se procede a su respuesta, de lo que se desprende lo siguiente:

OFERENTE: SUNTRAC S.A. TRACTORES DEL SOL
DÍA: 17-12-2020
HORA: 08H42

1.- ¿Los formularios que se debe presentar en la oferta, deben de estar debidamente firmados de manera electrónica por el representante de la persona jurídica?

Rta. Los formularios deben estar debidamente firmados por las personas naturales y/o representantes

legales de personas jurídicas ofertantes, el Procurador Común en caso de Consorcio o Compromiso de Consorcio, bien sea de manera electrónica o de manera manuscrita.
En caso de firmas electrónicas al momento de presentación de la oferta se deberá tomar en cuenta lo que dispone la ley de comercio electrónico, firmas y mensajes de datos, con la finalidad de conservar la integridad del documento electrónico.

OFERENTE: SAMAVCONST SA
DÍA: 17-12-2020
HORA: 09H25

1.- Por favor aclarar si la fecha límite para ingresar la documentación como futuro aliado estratégico es el 18 de diciembre, ya que la información que envían es para presentar una oferta completa. quedo pendiente a su respuesta, para tener claro el cronograma.

Rta. Según el cronograma establecido en el pliego signado con el numero AE- 001-2020-EP-CONST, la fecha límite para presentar las ofertas es el 30 de diciembre del 2020.
Las **PROPUESTAS** deberán entregarse en 2 sobres cerrados hasta el día de cierre del CONCURSO en la Gerencia General de EP-CONST, Av. Quito entre la Av. Rio Lelia y Parque de la Juventud de la ciudad de Santo Domingo, en horario laboral, es decir hasta las 16h00 (hora local).
No se aceptarán **PROPUESTAS** presentadas con posterioridad a la fecha y hora señaladas para el recibo de **PROPUESTAS** del CONCURSO o en lugar distinto al establecido en el párrafo anterior.
EP-CONST no será responsable de la apertura de una **PROPUESTA** o por no abrirla, en caso de no estar correctamente marcada o identificada que no haya sido entregada en el sitio correspondiente.

OFERENTE: SUNTRAC S.A. TRACTORES DEL SOL
DÍA: 17-12-2020
HORA: 10H21

1.- ¿para el formulario de compromiso personal técnico mínimo debe estar firmado de manera electrónica por el personal que proponga? Gracias por clara respuesta.

Rta. El formulario del personal técnico mínimo, debe estar debidamente firmado por las personas naturales y/o representantes legales de personas jurídicas ofertantes, el Procurador Común en caso de Consorcio o Compromiso de Consorcio, bien sea de manera electrónica o de manera manuscrita.
El formulario de Hoja de Vida de personal técnico mínimo y compromiso personal técnico mínimo, deberá estar firmado por cada profesional detallado en el formulario personal técnico mínimo, bien sea de manera electrónico o de manera manuscrita.
En caso de firmas electrónicas al momento de presentación de la oferta se deberá tomar en cuenta lo que dispone la ley de comercio electrónico, firmas y mensajes de datos, con la finalidad de conservar la integridad del documento electrónico.

2. solicitamos nos aclaren la fórmula para calcular los índices financieros.

Rta. De acuerdo lo estipulado en el numeral 30 de los Términos de Referencia:
Índices Financieros Mínimos:

Índice de Solvencia (mayor o igual a 1,0)
Fórmula de Cálculo:
Índice de Solvencia = Activo Corriente / Pasivo Corriente

INDICE SOLVENCIA (mayor o igual a 1,0)

fórmula	Activos Corriente / Pasivo Corriente
ejemplo	\$ 567.500,00 / \$ 378.000,00
IS =	1,501322751

Índice de Endeudamiento (menor a 1,5)
Fórmula de Cálculo:
Índice de Endeudamiento = Pasivo Total / Patrimonio

INDICE DE ENDEUDAMIENTO (Menor a 1,5)

fórmula	Pasivo Total / Patrimonio
ejemplo	\$ 850.000,00 / \$ 1.600.500,00
I E =	0,531084036

(Nota: Se deberá presentar la declaración de impuesto a la renta del ejercicio fiscal inmediato anterior que fue entregada al Servicio de Rentas Internas SRI.)

Los índices financieros del oferente, serán obtenidos de la Declaración del Impuesto a la Renta presentando al Servicio de Rentas Internas (SRI), correspondiente al último año de ejercicio económico y/o los balances presentados al órgano de control respectivo.

En caso de compromisos de asociación o consorcio el análisis de los índices financieros se realizará a partir de la suma de los índices de cada uno de los partícipes.

PARA COMPROMISOS DE ASOCIACION O CONSORCIO

SOCIO A 60% PARTICIPACION CONSORCIAL
SOCIO B 40% PARTICIPACION CONSORCIAL

INDICES	SOCIO A		SOCIO B		SUMAN INDICES PARA VALORACION	% CONSORCIAL SOCIO A	% CONSORCIAL SOCIO B	PONDERACION FINAL CONSORCIO
INDICE SOLVENCIA	\$ 1,50	+	\$ 1,02	=	\$ 2,52	0,90	0,41	1,31
INDICE DE ENDEUDAMIENTO	\$ 0,98	+	\$ 1,15	=	\$ 2,13	0,59	0,46	1,05

En el caso de un Consorcio Oferente o compromiso de Consorcio, deberá reportarse la información por cada miembro, y en el caso de los Índices deberán ser presentados por cada uno de manera individual y de manera conjunta en función de la participación en la relación consorcial.

3.- Para los formularios de información financiera donde va la firma del contador(a), él también debe formar de manera electrónica?

Rta. Los formularios de la información financiera deben estar firmados por las personas naturales y/o representantes legales de personas jurídicas ofertantes, el Procurador Común en caso de Consorcio o Compromiso de Consorcio, bien sea de manera electrónica o de manera manuscrita, de igual forma el contador(a).

- **a)** Formulario No. 4 Oferta Económica
  - A. CUMPLIMIENTO DE INDICADORES FINANCIEROS
  - B. INVARIABILIDD DE LA SITUACIÓN ECONÓMICA FINANCIERA DEL OFERENTE
  - C. ENTREGA DE EVALUACIÓN FINANCIERA

En caso de firmas electrónicas al momento de presentación de la oferta se deberá tomar en cuenta lo que dispone la ley de comercio electrónico, firmas y mensajes de datos, con la finalidad de conservar la integridad del documento electrónico.

OFERENTE: CONCALSA CONSTRUCTORA CALDERON S.A.
DÍA: 18-12-2020
HORA: 15H08

1.- ¿Se tendrá acceso a los estudios previos que sustentaron la elaboración de los TDR´s?

Rta. Los interesados podrán revisar la información solicitada en las oficinas dela EP-CONST, en los horarios establecidos de atención al cliente, se permitirá el acceso máximo a dos personas, respetando las normas de bioseguridad, bajo la supervisión de un técnico de la Dirección de Saneamiento y Gestión Ambiental, teniendo en cuenta que la fase de preguntas y aclaraciones ya ha finalizado.

2. Las empresas precalificadas como Aliados estratégicos (proceso de febrero 2020), ¿participan en las mismas condiciones que el resto de participantes? ¿Tienen alguna ventaja sobre los demás participantes?

Rta. De conformidad a lo que dispone el art. 17 del Reglamento de Selección del Aliado Estratégico que en su parte pertinente establece "*La convocatoria para el concurso será competencia del Gerente General de EP- CONST sin perjuicio de que se puedan realizar invitaciones directas a personas naturales o jurídicas del sector público o privado nacionales o extranjeras que se hayan identificado, propiciando la más amplia participación de potenciales interesados. Se podrá convocar a procesos de precalificación y manifestación de interés en atención a la complejidad y magnitud del proyecto. Finalizado el proceso de precalificación del cual se obtuvieren dos o más pre- calificados, se podrá realizar entre ellos el proceso de alianza estratégica. La convocatoria será publicada en la página web de la Empresa Pública de Obras Públicas, Vialidad, Vivienda y Seguridad Ciudadana EP-CONST; y, en uno de los periódicos de circulación local*". (énfasis añadido). Para el presente proceso NO se consideró ninguna diferencia entre los oferentes al proceso principal denominado "*IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO*" y los precalificados en el proceso denominado " GESTIÓN DE RESIDUOS SÓLIDOS (https://epconst.gob.ec/aliados-estrategicos/), por lo tanto todos los oferentes participan en las mismas condiciones, tal como consta en los documentos habilitantes del proceso.

3.- El servicio incluye también recolección, transporte y disposición final de desechos especiales, ya que este componente esta incluido en el diagrama de procesos de flujo del Complejo Ambiental? Pueden definir los "desechos especiales"?

Rta. El servicio incluye también el servicio de recolección, transporte y disposición final de neumáticos usados o partes de los mismos, que consta dentro del listado nacional de desechos especiales anexos C del acuerdo ministerial 142 y su código ES-04, incluye la recolección, transporte, disposición final, empaquetado y almacenamiento en sacos de 40kg., y cuya definición corresponde a: "Aquellos desechos, que sin ser peligrosos, por su naturaleza, pueden impactar el entorno ambiental o la salud, debido al volumen de generación y/o difícil degradación y para los cuales se debe implementar un sistema de recuperación, reúso y/o reciclaje con el fin de reducir la cantidad de desechos generados, evitar su inadecuado manejo y disposición, así como la sobresaturación de los rellenos sanitarios municipales".

4.- Favor indicar detalle de ítems y cantidades que comprende el kit antiderrame requerido para los vehículos recolectores que ingresen al Complejo Ambiental. Pág. 16 Requerimiento vehículos.

Rta. Los camiones deben contar con la bandeja de almacenamiento de lixiviados o percolados, además de contar con material absorbente suficiente para una emergencia. (que tenga una buena capacidad de absorción, manejo fácil y cómodo), cinta de peligro amarilla, 1 pala anticorrosiva, 5 sacos, 1 linterna, 3 pares de guantes de látex, 3 mascarillas, 3 gafas protectoras, 3 chalecos reflectivos.

5.- ¿Está determinado el procedimiento a seguirse en caso de que se produzcan, daños, fallas inhabilitaciones en la báscula única de pesaje del Complejo Ambiental? De ser afirmativa la respuesta, favor detallar el procedimiento a seguir.

Rta. Si, en caso de que se produzcan, daños, fallas inhabilitaciones en la báscula única de pesaje del complejo ambiental el procedimiento que se va seguir, es considerar los datos históricos de pesaje de los últimos 6 meses, y realizar un promedio; sin embargo, el operador deberá asegurar la operatividad de la báscula en un periodo máximo de 48 horas posteriores al daño.

Adicionalmente, se informa que la EP-CONST está realizando las gestiones necesarias para implementar una nueva bácula de pesaje

6.- ¿En el caso de determinarse otro sitio para la disposición final de los desechos diferente, del Complejo Ambiental ubicado en el km. 32 de la vía santo domingo Quevedo, ¿Existirá un reajuste del valor por tonelada debido a este cambio?

Rta. La EP-CONST, ha realizado sus estudios, en base a que estas circunstancias descritas en la pregunta, no sucedan, pero en caso que suceda este evento no se lo evaluará como reajuste del valor sino como nuevo costo que responderá a las nuevas condiciones geográficas, a las condiciones de acceso vial, y del tiempo que se necesite. El nuevo costo se lo determinará en común acuerdo.

7.- ¿Puede autorizarse el ingreso de un mismo operador con el mismo chofer al sitio de descarga, para asegurar que la descarga de desechos sea realizada de una forma eficiente y segura?

Rta. El nuevo operador del complejo ambiental debe contar con personal operativo, entre ellos, choferes con la suficiente experticia para asegurar la descarga de manera eficiente.

8.- Se establece la implementación de un plan piloto para la separación en la fuente y la recolección diferenciada de desechos… Como se determinara si el plan piloto entra en operación o si no es viable su implementación en toda la ciudad?

Rta. El aliado estratégico con su equipo de educación ambiental deberá implementar en los primeros 30 días después del inicio de operaciones un plan de trabajo donde especifique lugares y frecuencias donde se iniciarán el plan piloto de la recolección diferenciada y este debe ser aprobado por el administrador del contrato. Este servicio lo brindará el aliado estratégico sin que represente un incremento a la tarifa por el servicio de recolección, transporte y disposición final de desechos sólidos en el cantón santo domingo, en la implementación de la plataforma informática, responsabilidad del aliado estratégico, se determinan claramente las actividades previas para lograr una buena gestión del seguimiento, control y monitoreo de todas las actividades con la elaboración de encuestas, construcción de índices y demás información que nos permita determinar el grado de éxito del nuevo modelo de gestión integral de desechos sólidos, o si es necesario tomar correctivos de manera rápida y oportuna.

9.- Cuenta el complejo ambiental con los registros y licencias ambientales para el almacenamiento tempporal de desechos reciclables? Cuenta con los permisos y licencias como gestor ambiental que le permitan comercializar desechos reciclables?

Rta. El complejo ambiental cuenta con licencia ambiental emitida mediante resolución n.º 038 de fecha 12 de enero de 2012, el ministerio de ambiente otorga la licencia ambiental, para la ejecución del proyecto "complejo ambiental para la disposición final de los residuos sólidos del cantón santo domingo", ubicado en el cantón Santo Domingo, provincia de Santo Domingo de los Tsáchilas.

10.- ¿Respecto de la planta de tamizaje y ensacado, la EP-CONST garantiza el buen funcionamiento y completa operatividad de la misma al inicio de las operaciones?

Rta. La planta de tamizaje y ensacado se encuentra funcional y operativa.

11.- ¿Quién corre con el costo de reparaciones y/o repotenciaciones que se necesiten para su óptimo funcionamiento inicial?

Rta. la EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

12.- ¿Cuál es el proceso actual que se utiliza para la elaboración de el Compost con la finalidad de poder proponer una mejora de el mismo, tal como se requiere en estos pliegos?

Rta. El complejo ambiental cuenta con un área destinada para el compost, que incluye las fases de: fermentación, tamizaje y ensacado.

El aliado estratégico deberá incluir un proyecto de ejecución del proceso para la elaboración de compost de calidad para la comercialización del producto final, se recalca que desde su inicio de operación se debe realizar el trabajo de compostaje con los desechos de los mercados y ferias libres.

13. ¿En que presentaciones (sacos, fundas etc) se deberá obtener el producto final? ¿Cuenta el Complejo Ambiental con un área adecuada para el almacenamiento temporal del Producto previo a su comercialización?

Rta. El producto final deberá entregarse en presentación de sacos de 45kg.

El complejo ambiental cuenta con un área destinada para este fin, que incluye las fases de: fermentación, tamizaje y ensacado.

14. ¿Quién se hará cargo de la comercialización de el producto?

Rta. La EP-CONST se encargará de la comercialización del producto.

15. ¿Quién se hace cargo de la estiba, del producto una vez comercializado?

Rta. La estiba del producto estará a cargo de la EP-CONST.

16. ¿Se va a solicitar análisis periódicos de las características del compost resultante, quien corre con el costo?

Rta. Si se va a solicitar análisis periódicos ya que, se debe garantizar la calidad del proceso y del producto, los costos corren por cuenta del Aliado Estratégico.

17. ¿Respecto de las dos plantas para el tratamiento de los lixiviados, la EP-CONST garantiza el buen funcionamiento y completa operatividad de la misma al inicio de las operaciones?

Rta. La EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

18. ¿Quién corre con el costo de reparaciones y/o repotenciaciones que se necesiten para su óptimo funcionamiento inicial?

Rta. La EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

19. ¿De qué tiempo dispondrá el Aliado estratégico para preparar y capacitar adecuadamente a su personal propio sobre la operación y manejo de las plantas de tratamientos?

Rta. Deben ser actividades simultaneas con el personal de la EP-CONST por un tiempo máximo de 30 días, puesto que la gestión integral de residuos sólidos no puede suspenderse en ningún momento, conforme la normativa legal vigente.

20. ¿Cuál es el protocolo actual de utilización de productos químicos en las dos plantas de tratamientos?

Rta. El protocolo actual está ligado a lo que establece la normativa legal vigente, mismo que será entregado al aliado estratégico seleccionado.

21. Favor proporcionar especificaciones técnicas de la planta VSEP (marca, modelo, capacidad, componentes, etc), y de los materiales de recambio continuo (membranas, fltros, rulimanes, etc) para poder calcular costo de operacion de la misma

Rta. Las especificaciones técnicas de la Planta V-SEP, constarán en el Anexo 1 de la presente acta.

OFERENTE: Sonia Cacoango
DÍA: 18-12-2020
HORA: 15H42

1.- ¿Dentro de los términos de referencia se menciona un personal mínimo de recolección de la basura para el cantón Santo Domingo en el área urbana y rural, que pasaría si el operador disminuye su mano de obra mínima del requerimiento pero se mantiene la cobertura y la eficiencia de la recolección, este costo disminuiría el valor de la tonelada recogida para la liquidación de planillas?

Rta. Se deberá de mantener el personal mínimo que estipulan los Términos de RS.

2.- En el literal 19 en el equipo mínimo se solicitan 2 vehículos para supervisión y gerencia con un motor mínimo de 3.5cc solicito se aclare si se refiere a un motor de 3500cc o 3.5L?

Rta. Por un error de tipeo se hizo constar "un motor mínimo de 3.5cc", siendo lo correcto "un motor con una potencia mínima de 3.5 lt".

3.- ¿En el literal 19 en el equipo mínimo se solicita un taller de operaciones, el mismo que debe estar ubicado en un predio rustico o puede estar en una zona urbana?

Rta. El taller de Operaciones independientemente de su ubicación, debe cumplir con la normativa legal vigente.

4.- ¿En el punto 5.1.12 de los Términos de referencia en el que se menciona a MANTENIMIENTO en el literal a) VEHÍCULOS ,MAQUINARIA Y EQUIPOS , No se menciona ningún equipo para mantenimiento cuál sería el equipo mínimo para poder hacer el mantenimiento en las instalaciones del operador, para las cajas compactadoras y los camiones de recolección abierta?

Rta. Conforme la verificación de los equipos mínimos respecto al taller de mantenimiento es necesario aclarar que el taller de mantenimiento se refiere a la base de operaciones desde donde inicia diariamente el servicio el aliado estratégico y donde albergará su maquinaria pesada, por lo tanto, a más de los solicitado en los Términos de Referencia, el taller debe contar con: Compresores de aire, plataformas para cambios de aceite y lubricantes, puente grúa de mínimo 10 toneladas, elevador hidráulico, equipo de soldadura MIG, un juego de herramientas propias para un taller mecánico, y finalmente a fin de determinar los pesos de los vehículos a utilizar, una báscula debidamente calibrada de mínimo 40 toneladas.

OFERENTE: FRANCESCO CALDERON
DÍA: 18-12-2020
HORA: 15H45

1. ¿ Se tendrá acceso a los estudios previos que sustentaron la elaboración de los TDR´s?

Rta. Los interesados podrán revisar la información solicitada en las oficinas dela EP-CONST, en los horarios establecidos de atención al cliente, se permitirá el acceso máximo a dos personas, respetando las normas de bioseguridad, bajo la supervisión de un técnico de la Dirección de Saneamiento y Gestión Ambiental, teniendo en cuenta que la fase de preguntas y aclaraciones ya ha finalizado.

2. Las empresas precalificadas como Aliados estratégicos, ¿participan en las mismas condiciones que el resto de participantes? ¿Tienen alguna ventaja sobre los demás participantes?

Rta. De conformidad a lo que dispone el art. 17 del Reglamento de Selección del Aliado Estratégico que en su parte pertinente establece "*La convocatoria para el concurso será competencia del Gerente General de EP- CONST sin perjuicio de que se puedan realizar invitaciones directas a personas naturales o jurídicas del sector público o privado nacionales o extranjeras que se hayan identificado, propiciando la más amplia participación de potenciales interesados. Se podrá convocar a procesos de precalificación y manifestación de interés en atención a la complejidad y magnitud del proyecto. Finalizado el proceso de precalificación del cual se obtuvieren dos o más pre- calificados, se podrá realizar entre ellos el proceso de alianza estratégica. La convocatoria será publicada en la página web de la Empresa Pública de Obras Públicas, Vialidad, Vivienda y Seguridad Ciudadana EP-CONST; y, en uno de los periódicos de circulación local*". (énfasis añadido). Para el presente proceso NO se consideró ninguna diferencia entre los oferentes al proceso principal denominado "*IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO*" y los precalificados en el proceso denominado " GESTIÓN DE RESIDUOS SÓLIDOS (https://epconst.gob.ec/aliados-estrategicos/), por lo tanto todos los oferentes participan en las mismas condiciones, tal como consta en los documentos habilitantes del proceso.

3.- El servicio incluye también recolección, transporte y disposición final de desechos especiales, ya que este componente esta incluido en el diagrama de procesos de flujo del Complejo Ambiental.

Rta. El servicio incluye también el servicio de recolección, transporte y disposición final de neumáticos usados o partes de los mismos, que consta dentro del listado nacional de desechos especiales anexos C del acuerdo ministerial 142 y su código ES-04, incluye la recolección, transporte, disposición final, empaquetado y almacenamiento en sacos de 40kg.

4. ¿Puede establecerse un sistema de registro de tara individual de cada vehículo (que pueda será actualizado con una frecuencia determinada) con la finalidad de agilitar la salida de los vehículos del Complejo Ambiental?

Rta. El proceso de pasaje está establecido en los Términos de Referencia

5.- Favor indicar detalle de ítems y cantidades que comprende el kit antiderrame requerido para los vehículos recolectores que ingresen al Complejo Ambiental.

Rta. Los camiones deben contar con la bandeja de almacenamiento de lixiviados o percolados, además de contar con material absorbente suficiente para una emergencia. (que tenga una buena capacidad de absorción, manejo fácil y cómodo), cinta de peligro amarilla, 1 pala anticorrosiva, 5 sacos, 1 linterna, 3 pares de guantes de látex, 3 mascarillas, 3 gafas protectoras, 3 chalecos reflectivos.

6.- ¿Está determinado el procedimiento a seguirse en caso de que se produzcan, daños, fallas inhabilitaciones en la báscula única de pesaje del Complejo Ambiental? De ser afirmativa la respuesta, favor detallar el procedimiento a seguir.

Rta. Si, en caso de que se produzcan, daños, fallas inhabilitaciones en la báscula única de pesaje del complejo ambiental el procedimiento que se va seguir, es considerar los datos históricos de pesaje de los últimos 6 meses, y realizar un promedio; sin embargo, el operador deberá asegurar la operatividad de la báscula en un periodo máximo de 48 horas posteriores al daño.

Adicionalmente, se informa que la EP-CONST está realizando las gestiones necesarias para implementar una nueva bácula de pesaje.

7. ¿En el caso de determinarse otro sitio para la disposición final de los desechos diferente, del Complejo Ambiental ubicado en el km. 32 de la vía santo domingo Quevedo, ¿Existirá un reajuste del valor por tonelada debido a este cambio?

Rta. La EP-CONST, ha realizado sus estudios, en base a que estas circunstancias descritas en la pregunta, no sucedan, pero en caso que suceda este evento no se lo evaluará como reajuste del valor sino como nuevo costo que responderá a las nuevas condiciones geográficas, a las condiciones de acceso vial, y del tiempo que se necesite. El nuevo costo se lo determinará en común acuerdo.

8. ¿Puede autorizarse el ingreso de un mismo operador con el mismo chofer al sitio de descarga, para asegurar que la descarga de desechos sea realizada de una forma eficiente y segura?

Rta. El nuevo operador del complejo ambiental debe contar con personal operativo, entre ellos, choferes con la suficiente experticia para asegurar la descarga de manera eficiente

9. ¿Respecto de la planta de tamizaje y ensacado, la EP-CONST garantiza el buen funcionamiento y completa operatividad de la misma al inicio de las operaciones?

Rta. La planta de tamizaje y ensacado se encuentra funcional y operativa.

10. ¿Quién corre con el costo de reparaciones y/o repotenciaciones que se necesiten para su óptimo funcionamiento inicial?

Rta. La EP-CONST Entregará en su inicio en estado funcional y operativo. Si algo sucede más adelante será responsabilidad del aliado estratégico de dar el mantenimiento necesario repotenciación de planta primaria la asumirá el aliado estratégico.

11. ¿Cuál es el proceso actual que se utiliza para la elaboración de el Compost con la finalidad de poder proponer una mejora de el mismo, tal como se requiere en estos pliegos?

Rta. El complejo ambiental cuenta con un área destinada para este fin, que incluye las fases de: fermentación, tamizaje y ensacado.
El aliado estratégico deberá incluir un proyecto de ejecución del proceso para la elaboración de compost de calidad para la comercialización del producto final, se recalca que desde su inicio de operación se debe realizar el trabajo de compostaje con los desechos de los mercados y ferias libres.

12. ¿En que presentaciones (sacos, fundas etc) se deberá obtener el producto final?

Rta. El producto final del compost deberá entregarse en presentación de sacos de 45kg.

13. ¿Cuenta el Complejo Ambiental con un área adecuada para el almacenamiento temporal del Producto previo a su comercialización?

Rta. El complejo ambiental cuenta con un área destinada para el compost, que incluye las fases de: fermentación, tamizaje y ensacado.

14. ¿Quién se hará cargo de la comercialización de el producto?

Rta. La EP-CONST se encargará de la comercialización del producto..

15. ¿Quién se hace cargo de la estiba, del producto una vez comercializado?

Rta. La estiba del producto estará a cargo de la EP-CONST

16. ¿Se va a solicitar análisis periódicos de las características del compost resultante, quien corre con el costo?

Rta. Si se va a solicitar análisis periódicos ya que, se debe garantizar la calidad del proceso y del producto, los costos corren por cuenta del Aliado Estratégico.

17. ¿Respecto de las dos plantas para el tratamiento de los lixiviados, la EP-CONST garantiza el buen funcionamiento y completa operatividad de la misma al inicio de las operaciones?

Rta. La EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

18. ¿Quién corre con el costo de reparaciones y/o repotenciaciones que se necesiten para su óptimo funcionamiento inicial?

Rta. La EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

19. ¿De qué tiempo dispondrá el Aliado estratégico para preparar y capacitar adecuadamente a su personal propio sobre la operación y manejo de las plantas de tratamientos?

Rta. Deben ser actividades simultaneas con el personal de la EP-CONST por un tiempo máximo de 30 días, puesto que la gestión integral de residuos sólidos no puede suspenderse en ningún momento, conforme la normativa legal vigente.

20 ¿Cuál es el protocolo actual de utilización de productos químicos en las dos plantas de tratamientos?

Rta. El protocolo actual está ligado a lo que establece la normativa legal vigente, mismo que será entregado al aliado estratégico seleccionado.

OFERENTE: ECONCOSA S.A
DÍA: 18-12-2020
HORA: 15H54

1.- ¿Se puede indicar la cantidad de toneladas de materia orgánica que se procesarán para la elaboración de el Compost?

Rta. La cantidad de toneladas para la elaboración de compostaje se lo determinara una ves iniciado los planes pilotos de separación en la fuente.

2.- ¿En qué vehículos y de que lugares de la ciudad de Santo Domingo se realizará la recolección diferenciada de los desechos orgánicos?

Rta. El aliado estratégico con su equipo de educación ambiental deberá de implementar en los primeros 30 días después del inicio de operaciones un plan de trabajo donde especifique lugares y frecuencias donde se iniciarán el plan piloto de la recolección diferenciada y este debe ser aprobado por el administrador del contrato. Este servicio lo brindará el aliado estratégico sin que represente un incremento a la tarifa por el servicio de recolección, transporte y disposición final de desechos sólidos en el cantón santo domingo. Y los vehículos serán los q se estipularon en los Términos de Referencia.

3.- ¿Con que maquinaria, equipos e instalaciones cuenta la EP-CONST para el manejo de los desechos orgánicos y elaboración de compost?

Rta. El Complejo Ambiental cuenta con un área destinada para el proceso de elaboración de compost que incluye las fases de fermentación y deshidratado. Además de otra área donde se encuentra la máquina que realiza el proceso de tamizaje y ensacado.

4.- ¿Cuenta la EP-CONST con el área de almacenamiento, maquinaria para la carga y el traslado de materiales como el aserrín para la elaboración de las camas para la composta, quien correrá con los costos para la adquisición de este material?

Rta. La EP-CONST si cuenta con un área de almacenamiento de compost. La maquinaria para carga y traslado de materiales como el aserrín para la elaboración de las camas para la composta, se encuentran detalladas en el equipo mínimo solicitado en los Términos de Referencia. La elaboración del compost estará a cargo del aliado estratégico, por lo que los costos de adquisición de materiales e insumos correrá a cargo del mismo.

5.- ¿Cuenta la EP-CONST con la metodología para el funcionamiento de la planta Físico-Químico para el tratamiento de Lixiviados, podría facilitarse al Aliado Estratégico esta Información?

Rta. La EP-CONST si cuenta con la metodología para el funcionamiento de la planta Físico-Químico para el tratamiento de Lixiviados, la información se le facilitará al aliado estratégico seleccionado

6. ¿Desde la adquisición y funcionamiento de la planta Físico-Químico se deben obtener datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados, podría facilitarse esa información al Aliado Estratégico?

Rta. La EP-CONST si cuenta con datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados de la planta Físico-Químico, la información se le facilitará al aliado estratégico seleccionado

7.- ¿Quién proveerá los insumos químicos y biológicos para el funcionamiento de la planta de tratamiento primario para Lixiviados?

Rta. Conforme se establece en los Términos de Referencia, el Aliado Estratégico se encargará del buen funcionamiento y de mantener los insumos necesarios para el funcionamiento óptimo tanto de la planta primaria y V-SEP, así como de todo el complejo ambiental.

8.- ¿Quién realizará los mantenimientos a las plantas de tratamiento primario?

Rta. Conforme se establece en los Términos de Referencia, el Aliado Estratégico se encargará del buen funcionamiento y de mantener los insumos necesarios para el funcionamiento óptimo tanto de la planta primaria y V-SEP, así como de todo el complejo ambiental.

9.- ¿La EP-CONST cuenta con técnicos especializados en el funcionamiento de la planta VSEP, de tal forma que previo al inicio de operaciones en el complejo ambiental por el Aliado Estratégico, puedan dar una inducción completa de la operatividad de la planta VSEP?

Rta. Si, la EP-CONST cuenta con técnicos especializados en el funcionamiento de la planta VSEP, de tal forma que previo al inicio de operaciones en el complejo ambiental por parte del Aliado Estratégico, se programará una inducción completa de la operatividad de la planta VSEP

10.- ¿Cuenta la EP-CONST con datos históricos de rendimientos y producción por metros cúbicos de lixiviados tratados?

Rta. La EP-CONST si cuenta con datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados de la planta Físico-Químico.

11. ¿Qué insumos y cuantos mantenimientos se le debe realizar a la planta VSEP?

Rta. La información de los insumos químicos que se utilizan en la planta V-SEP será entregada al aliado seleccionado.

La planta se entregará en estado funcional y operativo para un año. Si en caso de ocurrir un desperfecto ocasionado por la operación del aliado estratégico este asumirá los costos de reparación mantenimiento e insumos según corresponda.

Para mayor información de la planta V-SEP, revisar el anexo 1.

12.- ¿Cuenta la EP-CONST con los costos operativos de la Planta VSEP?

Rta. Si, la EP-CONST cuenta con los costos operativos de la Planta VSEP

13. ¿Cuántas empresas en el Ecuador proveen este tipo de tecnología, debido a que cuenta con componentes como Módulos Vibratorios de Filtración de cillaza y Osmosis Inversas?

Rta. En Ecuador existe un proveedor único, representante de la empresa fabricante de la planta, mismo que se encarga del mantenimiento, repuestos y operatividad de la planta V-SEP.

14.- ¿Puede el Aliado estratégico presentar a la EP-CONST una nueva propuesta para el tratamiento de Lixiviados en el caso que con otro sistema se obtenga mejores niveles de rendimiento y producto tratado?

Rta. Si, el oferente puede presentar una nueva propuesta, pero la EP-CONST bajo criterio técnico propio determinará si es viable o no cambiar los métodos de tratamiento.

15.- ¿En base a que metodología se calificará el estado y manejo de las instalaciones del Complejo Ambiental?

Rta. Una vez seleccionado el aliado estratégico se calificará el estado y manejo del complejo ambiental en base a los indicadores comparativos con datos actuales y respetando las obligaciones establecidas por el aliado estratégico en los Términos de Referencia; bajo ninguna circunstancia se podrá paralizar este servicio.

16. ¿Deberá el Aliado Estratégico bajo su criterio presentar un cronograma valorado de actividades para socializarlo con la EP-CONST y previa planificación sustentada y documentada implementar un plan de visitas a las instalaciones del Complejo Ambiental?

Rta. El Aliado Estratégico si deberá presentar un cronograma valorado de actividades como parte de la metodología que es un componente de la oferta que deberán presentar.

Respecto al cronograma de vistas no será necesario, ya que el personal de la EP-CONST tendrá libre acceso a las instalaciones del complejo ambiental las 24 horas del día y los 365 días del año.

17. ¿El seguimiento, control y monitoreo de las descargas y de los cuerpos sensibles dentro el Complejo Ambiental se lo realiza mediante cualquiera laboratorio o debe ser Acreditado?

Rta. El seguimiento, control y monitoreo de las descargas y de los cuerpos sensibles dentro del Complejo Ambiental se lo realizará únicamente en laboratorios acreditados por el Servicio e Acreditación Ecuatoriana SAE.

18. ¿Cuenta la EP-CONST con las instalaciones y suficiente superficie (Espacio Físico) para implementar un sistema de fitorremediación, considerando que hay un tiempo determinado para que cada especie bio-acumule y considerando que la planta de tratamiento primario siempre va a ser retroalimentada con Lixiviados crudos?

Rta. El complejo ambiental si cuenta con un espacio físico para implementar un sistema de fitorremediación.

19. ¿Cuentan con estudios para la implementación del sistema de Fitorremediación?

Rta. Si se cuentan con estudios para la implementación del sistema de Fitorremediación.

20. ¿Tiene la EP-CONST la metodología a implementarse para el sistema de fitorremediación, en el caso que sea positivo se le facilitaría al Aliado Estratégico esta información?

Rta. Si se cuenta con la metodología para la implementación del sistema de fitorremediación. La información se entregará al Aliado Estratégico seleccionado.

21. ¿Tiene la EP-CONST análisis de las piscinas primarias, características de los Lixiviados crudos que ingresan al sistema primario, los pre tratados para la fase del sistema de fitorremediación, en especial la presencia y concentración de metales pesados?

Rta. La EP-CONST si cuenta con el análisis de las piscinas primarias, características de los Lixiviados crudos que ingresan al sistema primario, los pre tratados para la fase del sistema de fitorremediación.

22. ¿Tiene datos específicos la EP-CONST de los Pasivos Ambientales que generaría este sistema de Fitorremediación?

Rta. La EP-CONST si cuenta con datos específicos de los Pasivos Ambientales que generaría el sistema de Fitorremediación.

23. ¿Cuenta la EP-CONST con un plan emergente, de acción y cierre para el sistema de Fitorremediación?

Rta. La EP-CONST si cuenta con un plan emergente de acción y cierre para el sistema de Fitorremediación

24. ¿Podrá el Aliado Estratégico bajo su criterio sustentando técnicamente, desistir de manejar tal sistema o en el mejor de los casos seleccionar bajo su criterio una mejor alternativa?

Rta. El aliado estratégico deberá cumplir con lo establecido en los Términos de Referencia

25. ¿Tiene la EP-CONST datos sobre las cantidades de EM que se deben utilizar dentro del Complejo Ambiental?

Rta. La EP-CONST cuenta con información de los productos que se han utilizado en el complejo ambiental en los últimos años, sin embargo, la cantidad de EM (Microrganismos Eficientes) dependerá del producto que el oferente presente en su propuesta.

26. ¿Podría especificar en cual de todos los procesos que se van a realizar dentro de el Complejo Ambiental o en el Servicio de Recolección se utilizarían los EM?

Rta. Los EM (Microrganismos Eficientes) se utilizarán en todos los procesos dentro del complejo ambiental.

27. ¿Podrá el Aliado Estratégico bajo su criterio elaborar un cronograma valorado para realizar el control de plagas en el Complejo Ambiental?

Rta. El Aliado Estratégico si podrá elaborar un cronograma valorado para realizar el control de plagas en el Complejo Ambienta, pero este debe ser revisado y aprobado por la EP-CONST.

28. ¿Puede explicar por qué el Aliado Estratégico deberá coordinar la adquisición de insumos con la Dirección de Saneamiento y Gestión Ambiental?

Rta. En virtud que la EP-CONST es la entidad contratante, que administra y fiscaliza el cumplimiento del servicio, es indispensable que se coordine con ella la adquisición de insumos, con la finalidad de verificar su origen y funcionabilidad.

29. ¿Cuenta la EP-CONST con los equipos para la trituración de llantas?

Rta. Para el efecto deberá referirse al literal 9.5 pagina 46 de los Términos de Referencia.

30. ¿Podría el Aliado estratégico mediante un gestor autorizado entregar estos desechos de las llantas?

Rta. El aliado estratégico no podrá entregar los desechos de llantas a una tercera persona.

31. ¿Cuenta la EP-CONST con áreas destinadas para el almacenamiento de equipos y maquinarias?

Rta. La EP-CONST si cuenta áreas destinadas para el almacenamiento de equipos y maquinarias

32. ¿Dentro de los TDR´s no se considera personal en el área de mecánica y soldadura ni sus ayudantes tanto para el funcionamiento del Complejo Ambiental como para el servicio de recolección ayudantes.

Rta. Los Términos de Referencia en el numeral 6. contemplan el personal mínimo para la prestación del servicio, en caso de que el oferente considere necesario presentar en su oferta personal adicional, esto no afectará el valor contractual.

33. Así mismo no cuentan con un área de lavado y desinfección de los equipos tampoco se esta considerando un jefe de talleres y mucho menos el personal para realizar el barrido dentro de la ciudad, tampoco se considera personal para el manejo del laboratorio, área de compostaje, planta se separación, área de tamizaje y mucho menos los profesionales en el área ambiental, química, médica y legal. Puede explicar por que?

Rta. Los Términos de Referencia en el numeral 6. contemplan el personal mínimo para la prestación del servicio, en caso de que el oferente considere necesario presentar en su oferta personal adicional, esto no afectará el valor contractual

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H29

1. Revisado los pliegos y según lo señalado en el artículo 5 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala "Alianza Estratégica: Acuerdo de tipo comercial y/o productivo que liga facetas específicas de los negocios de dos o más personas naturales o jurídicas, públicas o privadas, que produzcan o presten los mismos servicios y/o productos o que sean complementarios para el cumplimiento de sus fines empresariales, potenciando la efectividad de las estrategias competitivas de sus participantes, a través del intercambio de tecnologías, habilidades o productos, o del aporte de materia prima, capital, conocimientos del mercado, ventas, canales de distribución y colocación para obtener el mismo objetivo. No implicará la pérdida de la identidad e individualidad de la Empresa Pública de Obras Pública, Vialidad, Vivienda y Seguridad Ciudadana EP-CONST.

¿Sírvanse establecer cual es el intercambio de tecnologías, habilidades o productos, o del aporte de materia prima, capital, conocimientos del mercado, ventas, canales de distribución y colocación para obtener el mismo objetivo que se pretende obtener con este concurso por parte del Aliado Estratégico?

Rta. El requerimiento de la EP-CONST conforme la legislación vigente, busca optimizar los procesos de las personas naturales o jurídicas que participen como aliados, las propuestas determinarán su experiencia en la realización de este tipo de trabajos.

En tal virtud, como transferencia de tecnología, se solicita:

La implementación de una plataforma tecnológica que tendrá varios componentes que implican una gestión para su implementación de uso exclusivo de la EP-CONST.

Así como también el equipo destinado para la trituración y tratamiento de las llantas quedará para uso de la EP-CONST.

Finalmente, el aporte de capital se verá reflejado en el financiamiento que aportará el aliado estratégico seleccionado durante los primeros 6 meses del servicio conforme consta en el numeral 12 de los Términos de Referencia.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H30

1.- Revisado los pliegos y según lo señalado en el artículo 11 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala "(...) dispondrá de un informe técnico financiero y jurídico, debidamente sustentado respecto de la necesidad y/o conveniencia de llevar adelante el proceso de alianza estratégica, asociación público privada, o de cualquier otra modalidad aceptada por el ordenamiento jurídico ecuatoriano; y que dicho proceso no se pueda efectuar a través de las modalidad es de contratación previstos en la Ley Orgánica del Sistema Nacional de Contratación Pública";

Al no constar dicho informe en los documentos habilitantes, solicito se sirvan adjuntar el mismo, o establezcan los motivos de ¿porque este proceso no puede ser efectuado por la Ley Orgánica del Sistema Nacional de Contratación Pública?

Rta. Conforme la Legislación vigente las Empresas Públicas tienen capacidad asociativa y el cuerpo colegiado tiene autonomía para determinar este tipo de contratación. El artículo 4 de la Ley Orgánica de Empresas Públicas define a las empresas públicas como "*...entidades que pertenecen al Estado en los términos que establece la Constitución de la República, personas jurídicas de derecho público, con patrimonio propio, dotadas de autonomía presupuestaria, financiera, económica, administrativa y de gestión (...)*".

El artículo 34 de la Ley Orgánica de Empresas Públicas respecto a la contratación de las empresas públicas señala que lo podrá realizar bajo régimen especial o régimen común, en base a su autonomía.

El artículo 35 de la Ley Orgánica de Empresas Públicas señala que " *Las empresas públicas tienen capacidad asociativa para el cumplimiento de sus fines y objetivos empresariales y en consecuencia para la celebración de los contratos que se requieran, para cuyo efecto podrán constituir cualquier tipo de asociación, alianzas estratégicas, sociedades de economía mixta con sectores públicos o privados en el ámbito nacional o internacional o del sector de la economía popular y solidaria, en el marco de las disposiciones del artículo 316 de la Constitución de la República.*

Al ser la Alianza estratégica una facultad e de las empresas públicas y un mecanismo legal de contratación La PROCURADURÍA GENERAL DEL ESTADO, mediante oficio No. 10100 de fecha 09 de octubre de 2012; determina "(...) que corresponde al Directorio, determinar los requisitos y procedimientos para la selección de socios privados. De igual manera, es responsabilidad del Directorio precautelar la legalidad y transparencia del proceso, así como las condiciones de participación de la empresa pública.

La conveniencia de constituir asociación, alianza estratégica o una sociedad de economía mixta y, en general, de escoger una forma asociativa, así como de establecer los requisitos y procedimientos para seleccionar un socio privado, son de competencia del directorio de la empresa pública...". (Énfasis añadido)
La Empresa Pública de Obras Públicas, Vialidad, Vivienda, Seguridad Ciudadana y de Aseo de Santo Domingo por su naturaleza, se encuentra sujeta al ámbito de aplicación de la Ley Orgánica de Empresas Públicas (LOEP), de conformidad con lo establecido en los artículos 34 y 35.

La conveniencia de constituir una asociación o consorcio, en general, de escoger una forma asociativa, así como la determinación de los requisitos y procedimientos para escoger un socio privado y las condiciones de participación de la Empresa, es de responsabilidad de los personeros de la misma. Es decir, que correspondió al Directorio de la EP-CONST determinar los requisitos o procedimientos para la selección de socios privados, precautelando el interés público y conveniencia institucional respecto a la suscripción de alianzas estratégicas, cumpliendo con el principio de legalidad, transparencia del proceso y las condiciones de participación de la empresa pública.

Por lo que, Mediante Certificación No. 006-06-032 que contiene la Resolución No. EP-CONST-WEA-SE-006-2020-05-19-05, de fecha 19 de mayo de 2020, con fundamento en las disposiciones legales previstas en los artículos 9 de la Ley Orgánica de Empresas Públicas, y artículo 13 de la Ordenanza de Creación de la Empresa Pública, el Directorio de la misma RESOLVIÓ: "*A través de votación Ordinaria AUTORIZAR EL INICIO DE LOS SIGUIENTES PROCESOS DE ALIANZAS ESTRATÉGICAS (...) IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO(...)*"
La figura de la capacidad asociativa, contemplada en el artículo 35 de la Ley Orgánica de Empresas Públicas, es una figura que abarca a las alianzas estratégicas, en base a la autonomía de la Empresas Públicas, para mejorar su gestión y cumplir con su objeto de creación.

Por lo que, para la ejecución del Proyecto para *IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO*, se considera viable la asociación con un sujeto de Derecho Privado, mediante la celebración de un contrato de alianza estratégica, con la finalidad de optimizar el uso de los recursos públicos, distribuir los riesgos y beneficios del Proyecto y conseguir la participación privada para atender el cumplimiento del objeto del mismo, cumpliendo con el principio de legalidad, transparencia del proceso y las condiciones de participación de la empresa pública.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H31

1.- Revisado los pliegos y según lo señalado en el artículo 9 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala será la responsabilidad del Gerente General la de la aplicación de criterios técnicos y buenas prácticas internacionales aceptadas para:

a. Identificación de riesgos;
b. Valoración de riesgos;
c. Minimización de su impacto para la Empresa;

MUNICIPALIDAD Santo Domingo

EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y DE ASEO DE SANTO DOMINGO "EP-CONST"

EP EMPRESA PÚBLICA CONST

d. Garantía de efectiva transferencia del riesgo.¿Solicito se sirvan disponer claramente determinen los elementos de riesgo al amparo de la norma aprobada por el Directorio de la EP-CONST?

Rta. Ante la inquietud planteada me permito adjuntar la matriz de riesgos de la Empresa Pública EP-CONST cuyo código del proceso es AE-001-2020-EP-CONST elaborado por la Dirección Financiera y aprobado por la Gerencia General.

MATRIZ DE RIESGOS EMPRESA EP-CONST PARA EL PROYECTO DE CÓDIGO DEL PROCESO: AE-001-2020-EP-CONST

UNIDAD: DIRECCION FINANCIERA

FECHA: 7 DE DICIEMBRE 2020

MAPA DE RIESGOS

IDENTIFICACIÓN DEL RIESGO			Factores externos					Factores internos				ANÁLISIS Y VALORACIÓN DEL RIESGO			Riesgo Inherente						Riesgo Residual		
Nº	RIESGO	Descripción del Riesgo	Económicos	Medioambientales	Políticos y Legales	Sociales	Tecnológicos	Infraestructura	Personal	Procesos	Tecnología	Importancia	Probabilidad	Impacto	TOTAL	NIVEL	Controles Existentes	Importancia	Probabilidad	Impacto	TOTAL	NIVEL	MITIGACION
1	FINANCIAMIENTO	RECURSOS ECONOMICOS NO DISPONIBLES - FLUJOS EFECTIVOS	X		X					X		10	3	2	60	ALTO	ALIADO ESTRATEGICO	10	2	1	20	MODERADO	NIVELES DE CAPITAL MINIMO/ GARANTIAS ACREEDORES E HIPOTECA
2	PLAZO Y CONDICIONES DE LA DEUDA	QUE SE EXCEDA EL PLAZO DE LA DEUDA	X		X					X		10	3	2	60	ALTO	CONTRATOS SUSCRITOS	10	2	1	20	MODERADO	ADECUACION DE LA FINANCIACION A LOS FLUJOS DEL PROYECTO /APORTE DE UN MAYOR NIVEL DE CAPITAL
3	INCUMPLIMIENTO DEL SERVICIO DE LA DEUDA	NO CUMPLIR CON LA TABLA DE PAGOS FECHAS ACORDADAS	X			X				X		10	2	2	40	ALTO	FLUJO DE CAJA	10	2	1	20	MODERADO	REESTRUCTURACION FINANCIERA
4	NORMATIVOS	CAMBIOS EN LA LEGISLACION ECUATORIANA Y ORDENANZA MCPL EPCONST	X		X					X		9	2	1	18	MODERADO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	8	2	1	16	MODERADO	REEQUILIBRIO ECONOMICO-FINANCIERO
5	REGIMEN CAMBIARIO	CAMBIO EN POLITICAS ECONOMICAS ASUMIDAS POR EL PAIS			X		X			X		8	2	2	32	ALTO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	6	2	2	24	MODERADO	SOLICITUD DE FINANCIAMIENTO
6	SINIESTROS NATURALES IMPREDECIBLES	PANDEMIAS, TERREMOTOS, INUNDACIONES		X					X			8	2	1	16	MODERADO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	8	1	1	8	BAJO	ninguna

Elaborado:	DIRECTORA FINANCIERA	Revisado:	GERENTE GENERAL
Nombre:	LIC. ELIANA DURAN	Nombre:	ING PATRICIO SILVA
Firma:		Firma:	

Probabilidad		Rango %	
3	Alto	>30	ocurrira siempre o casi siempre
2	Media	>10	ocurrida en algunas veces
1	Bajo	1 a 10	ocurrira rara vez

Impacto		
3	Catastrofico	
2	Moderado	
1	Insignificante	

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H32

1.- Revisados los pliegos y términos de referencia se establece en la forma de pago y condiciones, que la EP-CONST pagará en el último mes del contrato al Aliado Estrategico la cantidad de ..., más la diferencia de los meses que el privado aportó económicamente con el proyecto es decir del mes 1, 2, 3, 4, 5, y 6, para lo cual el Administrador del Contrato deberá realizar una reliquidación en base a las toneladas recogidas y/o tratadas durante el tiempo de ejecución del contrato.

¿Solicito se sirvan aclarar cual es la diferencia entre este proceso y un proceso seguido mediante el Sistema Nacional de Contratación Pública?

Es importante en este punto señalar que la Asamblea Nacional ha aprobado el tipo penal de elusión de procedimiento de contratación, cuando una entidad busca evadir el camino de un proceso que a todas luces es regulado por la LOSNCP, por otra figura.

Rta. El artículo 35 de la Ley Orgánica de Empresas Públicas señala que " *Las empresas públicas tienen capacidad asociativa para el cumplimiento de sus fines y objetivos empresariales y en consecuencia para la celebración de los contratos que se requieran, para cuyo efecto podrán constituir cualquier tipo de asociación, alianzas estratégicas, sociedades de economía mixta con sectores públicos o privados en el ámbito nacional o internacional o del sector de la economía popular y solidaria, en el marco de las disposiciones del artículo 316 de la Constitución de la República.*
El artículo 42 de la Ley Orgánica de Empresas Públicas determina que " *Las empresas públicas sus subsidiarias y filiales podrán adoptar las formas de financiamiento que estimen pertinentes para cumplir sus fines y objetivos empresariales, tales como: ingresos provenientes de la comercialización de bienes y prestación de servicios así como de otros emprendimientos; rentas de cualquier clase que produzcan los activos, acciones, participaciones; acceso a los mercados financieros, nacionales o internacionales, a través de emisión de obligaciones, titularizaciones, contratación de créditos; beneficio de garantía soberana; inyección directa de recursos estatales, reinversión de recursos propios; entre otros"*

La capacidad asociativa de las Empresa Públicas, permiten iniciar procesos bajo los cuales no se tiene el financiamiento total, y sobre los cuales se debe contar con una fuente de repago a futuro para asegurar la inversión del privado para el cumplimiento de sus fines y objetivos; y garantizar la prestación de sus servicios públicos.

La Ley Orgánica del Sistema Nacional de Contratación Pública en su artículo 24 indica que *Las entidades previamente a la convocatoria, deberán certificar la disponibilidad presupuestaria y la existencia presente o futura de recursos suficientes para cubrir las obligaciones derivadas de la contratación"* al contar con una partida que no cumple el monto total del proyecto y al no tener una certificación futura de los fondos, bajo la capacidad asociativa y las formas de financiamiento de las empresas públicas se realiza bajo la modalidad de alianza estratégica para obtener el financiamiento de los 6 primeros meses del proyecto.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H32

1.- Revisados los pliegos y términos de referencia se establece que no existe reajuste de precio y que el contratista debe renunciar al mismo, pero párrafo abajo se establece una formula polinómica.

¿Sírvanse aclarar si va a existir reajusto o no, acorde a los señalado?

Rta. En efecto no existe reajuste de precios, por lo tanto, no existe fórmula polinómica, sin embargo, se establece una formula con un término que busca mantener el equilibrio económico en función de las publicaciones oficiales del INEC, para no generar ningún perjuicio al Aliado Estratégico.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H33

1.- Revisados los pliegos y términos de referencia se establece 17 experiencia general, párrafo cuarto: "De igual manera para los profesionales que participan individualmente, será acreditable la experiencia adquirida en relación de dependencia, ya sea en calidad administrador, o cargos afines de acuerdo a la invitación y su valoración cuando gire en torno a los montos contractuales, se cumplieran considerando el 40% del valor del contrato en el que tales profesionales participaron en las calidades que se señalaron anteriormente."

Más allá de los errores de redacción, solicitamos se sirvan aclarar lo siguiente:

• Que es un cargo "afín" de acuerdo a la invitación ¿?; el mensajero de una empresa con el fin puede cumplir el requisito.

Rta. Respecto al párrafo en mención cargos afines hace referencia a Administrador del Contrato, Gerente de Proyectos, Administradores técnicos de proyectos, superintendentes que han participado en actividades relacionadas a la gestión de residuos sólidos tanto en el ámbito público como en el privado, el texto debe ser analizado de manera integral, por lo tanto, no hace referencia al mensajero de la empresa ni a cargos que no tengan relación con lo solicitado.

• Que se debe entender por "su valoración cuando gire en torno a los montos contractuales, se cumplieran considerando el 40% del valor del contrato en el que tales profesionales participaron" si el profesional "afín" (indeterminable, mensajero o conserje) con un sueldo máximo de mil dólares, por cuanto su patrono tuvo un contrato de 20 millones, este personaje podrá acreditar 8 millones como experiencia?

Rta. El 40 % hace referencia al monto total del contrato presentado como experiencia, siempre y cuando su participación se relacione como Administrador del Contrato, Gerente de Proyectos, Administradores técnicos de proyectos, superintendentes que han participado en actividades relacionadas a la gestión de residuos sólidos tanto en el ámbito público como en el privado

• Cuanto años de relación de dependencia le acreditarán al trabajador la experiencia del patrono? UN mes, dos meses, todo el monto del contrato?

Rta. Deberá cumplir el tiempo mínimo que se justifique con el 40 % más de avance del proyecto que se presenta como experiencia

Las preguntas nacen en función de lo inentendible de dicho párrafo, pues un trabajador de quien TUVO el contrato, no puede acreditar la experiencia de dueño del contrato, puede probar su experiencia para personal asignado, pero no para "Aliado Estratégico".

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H33

1.- Revisados los pliegos y términos de referencia que financiamiento se espera del Aliado Estratégico, si al final, conforme los pliegos punto 12 igual le van a pagar los montos no cobrados?

Rta. En la forma de pago se estableció los aportes que hace el Aliado Estratégico privado mensualmente cuya liquidación se realizará en el ultimo mes de trabajo, adicionalmente a los trabajos ordinarios de gestión integral de la basura el Aliado debe incrementarnos una herramienta tecnológica que será de uso exclusivo de la EP-CONST y que será entregado por el Aliado al final para su uso futuro, también será necesario implementar por parte del Aliado Estratégico equipos que permitan un reciclaje de ciertos materiales, deberá el Aliado suministrar, instalar y operar dichos equipos durante el periodo del contrato y al final pasara a ser un bien de la EP-CONST.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H34

1.- Revisados los pliegos y términos de referencia no se solicita equipo NUEVO, sino que puede tener hasta una vida útil de máximo 12 años; es decir, se espera prestar el servicio de recolección con equipos viejos?

Rta. En razón de que el tiempo de ejecución del contrato esta ligado al valor de la partida económica existente a la fecha de la convocatoria solo se establece un año de intervención lo cual limitaría a muy pocos participantes que puedan obtener o tener equipos nuevos la posibilidad de entregar una oferta, por lo que se da la alternativa de usar equipos usados que deberán ser previamente verificados por los técnicos de la empresa y aprobados para su uso.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H34

1.- Revisados los pliegos y términos de referencia se establece una declaración juramentada de, en caso de ser adjudicado, contar con los recursos económico para ejecutar el proceso.

¿Cual es el motivo de dicha declaración, si conforme el numeral 12 de los términos de referencia más la diferencia de los meses que el privado aportó económicamente con el proyecto es decir del mes 1, 2, 3, 4, 5, y 6, para lo cual el Administrador del Contrato deberá realizar una reliquidación en base a las toneladas recogidas y/o tratadas durante el tiempo de ejecución del contrato será cancelada al Adjudicatario?

Rta. Con la declaración juramentada se busca garantizar los recursos económicos para la debida ejecución del contrato, le recordamos que el pago se hará en función del trabajo efectivamente realizado.

OFERENTE: ERVAMI S.A.
DÍA: 18-12-2020
HORA: 16H36

1. - Revisado los pliegos y según lo señalado en el artículo 5 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala "Alianza Estratégica: Acuerdo de tipo comercial y/o productivo que liga facetas específicas de los negocios de dos o más personas naturales o jurídicas, públicas o privadas, que produzcan o presten los mismos servicios y/o productos o que sean complementarios para el cumplimiento de sus fines empresariales, potenciando la efectividad de las estrategias competitivas de sus participantes, a través del intercambio de tecnologías, habilidades o productos, o del aporte de materia prima, capital, conocimientos del mercado, ventas, canales de distribución y colocación para obtener el mismo objetivo. No implicará la pérdida de la identidad e individualidad de la Empresa Pública de Obras Pública, Vialidad, Vivienda y Seguridad Ciudadana EP-CONST. ¿Sírvanse establecer cual es el intercambio de tecnologías, habilidades o productos, o del aporte de materia prima, capital, conocimientos del mercado, ventas, canales de distribución y colocación para obtener el mismo objetivo que se pretende obtener con este concurso porparte del Aliado Estratégico?

Rta. El requerimiento de la EP-CONST conforme la legislación vigente, busca optimizar los procesos de las personas naturales o jurídicas que participen como aliados, las propuestas determinarán su experiencia en la realización de este tipo de trabajos.

En tal virtud, como transferencia de tecnología, se solicita:

La implementación de una plataforma tecnológica que tendrá varios componentes que implican una gestión para su implementación de uso exclusivo de la EP-CONST.

Así como también el equipo destinado para la trituración y tratamiento de las llantas quedará para uso de la EP-CONST.

Finalmente, el aporte de capital se verá reflejado en el financiamiento que aportará el aliado estratégico seleccionado durante los primeros 6 meses del servicio conforme consta en el numeral 12 de los Términos de Referencia.

2.- Revisado los pliegos y según lo señalado en el artículo 11 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala "(...) dispondrá de un informe técnico financiero y jurídico, debidamente sustentado respecto de la necesidad y/o conveniencia de llevar adelante el proceso de alianza estratégica, asociación público privada, o de cualquier otra modalidad aceptada por el ordenamiento jurídico ecuatoriano; y que dicho proceso no se pueda efectuar a través de las modalidad es de contratación previstos en la Ley Orgánica del Sistema Nacional de Contratación Pública"; Al no constar dicho informe en los documentos habilitantes, solicito se sirvan adjuntar el mismo, o establezcan los motivos de ¿porqueeste proceso no puede ser efectuado por la Ley Orgánica del Sistema Nacional de Contratación Pública?

Rta. Conforme la Legislación vigente las Empresas Públicas tienen capacidad asociativa y el cuerpo colegiado tiene autonomía para determinar este tipo de contratación. El artículo 4 de la Ley Orgánica de Empresas Públicas define a las empresas públicas como *"...entidades que pertenecen al Estado en los términos que establece la Constitución de la República, personas jurídicas de derecho público, con patrimonio propio, dotadas de autonomía presupuestaria, financiera, económica, administrativa y de gestión (...)".*

El artículo 34 de la Ley Orgánica de Empresas Públicas respecto a la contratación de las empresas públicas señala que lo podrá realizar bajo régimen especial o régimen común, en base a su autonomía.

El artículo 35 de la Ley Orgánica de Empresas Públicas señala que " *Las empresas públicas tienen capacidad asociativa para el cumplimiento de sus fines y objetivos empresariales y en consecuencia para la celebración de los contratos que se requieran, para cuyo efecto podrán constituir cualquier tipo de asociación, alianzas estratégicas, sociedades de economía mixta con sectores públicos o privados en el ámbito nacional o internacional o del sector de la economía popular y solidaria, en el marco de las disposiciones del artículo 316 de la Constitución de la República.*

Al ser la Alianza estratégica una facultad e de las empresas públicas y un mecanismo legal de contratación La PROCURADURÍA GENERAL DEL ESTADO, mediante oficio No. 10100 de fecha 09 de octubre de 2012; determina "(...) que corresponde al Directorio, determinar los requisitos y procedimientos para la selección de socios privados. De igual manera, es responsabilidad del Directorio precautelar la legalidad y transparencia del proceso, así como las condiciones de participación de la empresa pública. La conveniencia de constituir asociación, alianza estratégica o una sociedad de economía mixta y, en general, de escoger una forma asociativa, así como de establecer los requisitos y procedimientos para seleccionar un socio privado, son de competencia del directorio de la empresa pública...". (Énfasis añadido)
La Empresa Pública de Obras Públicas, Vialidad, Vivienda, Seguridad Ciudadana y de Aseo de Santo Domingo por su naturaleza, se encuentra sujeta al ámbito de aplicación de la Ley Orgánica de Empresas Públicas (LOEP), de conformidad con lo establecido en los artículos 34 y 35.

La conveniencia de constituir una asociación o consorcio, en general, de escoger una forma asociativa, así como la determinación de los requisitos y procedimientos para escoger un socio privado y las condiciones de participación de la Empresa, es de responsabilidad de los personeros de la misma. Es decir, que correspondió al Directorio de la EP-CONST determinar los requisitos o procedimientos para la selección de socios privados, precautelando el interés público y conveniencia institucional respecto a la suscripción de alianzas estratégicas, cumpliendo con el principio de legalidad, transparencia del proceso y las condiciones de participación de la empresa pública.

Por lo que, Mediante Certificación No. 006-06-032 que contiene la Resolución No. EP-CONST-WEA-SE-006-2020-05-19-05, de fecha 19 de mayo de 2020, con fundamento en las disposiciones legales previstas en los artículos 9 de la Ley Orgánica de Empresas Públicas, y artículo 13 de la Ordenanza de Creación de la Empresa Pública, el Directorio de la misma RESOLVIÓ: *"A través de votación Ordinaria AUTORIZAR EL INICIO DE LOS SIGUIENTES PROCESOS DE ALIANZAS ESTRATÉGICAS (...) IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO(...)"*

La figura de la capacidad asociativa, contemplada en el artículo 35 de la Ley Orgánica de Empresas Públicas, es una figura que abarca a las alianzas estratégicas, en base a la autonomía de la Empresas Públicas, para mejorar su gestión y cumplir con su objeto de creación.

Por lo que, para la ejecución del Proyecto para *IDENTIFICAR, SELECCIONAR UN ALIADO ESTRATÉGICO Y CONFORMAR UNA ALIANZA ESTRATÉGICA CON LA EMPRESA PÚBLICA DE OBRAS PÚBLICAS, VIALIDAD, VIVIENDA, SEGURIDAD CIUDADANA Y ASEO EP-CONST CON EL OBJETO DE REALIZAR LA RECOLECCIÓN, BARRIDO, TRANSPORTE Y DISPOSICIÓN FINAL DE LOS RESIDUOS SÓLIDOS GENERADOS EN EL CANTÓN SANTO DOMINGO*, se considera viable la asociación con un sujeto de Derecho Privado, mediante la celebración de un contrato de alianza estratégica, con la finalidad de optimizar el uso de los recursos públicos, distribuir los riesgos y beneficios del Proyecto y conseguir la participación privada para atender el cumplimiento del objeto del mismo, cumpliendo con el principio de legalidad, transparencia del proceso y las condiciones de participación de la empresa pública.

3.- Revisado los pliegos y según lo señalado en el artículo 9 del Reglamento de Asociatividad aprobado por la EP-CONST, que señala será la responsabilidad del Gerente General la de la aplicación de criterios técnicos y buenas prácticas internacionales aceptadas para: a. Identificación de riesgos ; b.Valoración de riesgos; c. Minimización de su impacto para la Empresa; d.Garantía de efectiva transferencia del riesgo. ¿Solicito se sirvan disponer claramente determinen los elementos de riesgo al amparo de la norma aprobada por el Directorio de la EP-CONST?

Rta. Ante la inquietud planteada me permito adjuntar la matriz de riesgos de la Empresa Pública EP-CONST cuyo código del proceso es AE-001-2020-EP-CONST elaborado por la Dirección Financiera y aprobado por la Gerencia General.

MATRIZ DE RIESGOS EMPRESA EP-CONST PARA EL PROYECTO DE CÓDIGO DEL PROCESO: AE-001-2020-EP-CONST

UNIDAD: DIRECCION FINANCIERA

FECHA: 7 DE DICIEMBRE 2020

MAPA DE RIESGOS

IDENTIFICACIÓN DEL RIESGO												ANÁLISIS Y VALORACIÓN DEL RIESGO											
Nº	RIESGO	Descripción del Riesgo	Factores externos					Factores internos				Importancia	Probabilidad	Impacto	Riesgo Inherente		Controles Existentes	Importancia	Probabilidad	Impacto	Riesgo Residual		MITIGACION
			Económicos	Medioambientales	Políticos y Legales	Sociales	Tecnológicos	Infraestructura	Personal	Procesos	Tecnología				TOTAL	NIVEL					TOTAL	NIVEL	
1	FINANCIAMIENTO	RECURSOS ECONOMICOS NO DISPONIBLES - FLUJOS EFECTIVOS	X		x					X		10	3	2	60	ALTO	ALIADO ESTRATEGICO	10	2	1	20	MODERADO	NIVELES DE CAPITAL MINIMO/ GARANTIAS ACREEDORES E HIPOTECA
2	PLAZO Y CONDICIONES DE LA DEUDA	QUE SE EXCEDA EL PLAZO DE LA DEUDA	X		X					X		10	3	2	60	ALTO	CONTRATOS SUSCRITOS	10	2	1	20	MODERADO	ADECUACION DE LA FINANCIACION A LOS FLUJOS DEL PROYECTO /APORTE DE UN MAYOR NIVEL DE CAPITAL
3	INCLUMPLIMIENTO DEL SERVICIO DE LA DEUDA	NO CUMPLIR CON LA TABLA DE PAGOS FECHAS ACORDADAS	X			X				X		10	2	2	40	ALTO	FLUJO DE CAJA	10	2	1	20	MODERADO	REESTRUCTURACION FINANCIERA
4	NORMATIVOS	CAMBIOS EN LA LEGISLACION ECUATORIANA Y ORDENANZA MCPL EPCONST	X		X					X		9	2	1	18	MODERADO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	8	2	1	16	MODERADO	REEQUILIBRIO ECONOMICO-FINANCIERO
5	REGIMEN CAMBIARIO	CAMBIO EN POLITICAS ECONOMICAS ASUMIDAS POR EL PAIS			X		X			X		8	2	2	32	ALTO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	6	2	2	24	MODERADO	SOLICITUD DE FINANCIAMIENTO
6	SINIESTROS NATURALES IMPREDECIBLES	PANDEMIAS, TERREMOTOS, INUNDACIONES		X					X			8	2	1	16	MODERADO	NINGUNO DEPENDE DE UN FACTOR EXTERNO	8	1	1	8	BAJO	ninguna

Elaborado:	DIRECTORA FINANCIERA	Revisado:	GERENTE GENERAL
Nombre:	LIC. ELIANA DURAN	Nombre:	ING PATRICIO SILVA
Firma:		Firma:	

	Probabilidad	Rango %	
3	Alto	>30	ocurrira siempre o casi siempre
2	Media	>10	ocurrida en algunas veces
1	Bajo	1 a 10	ocurrira rara vez

	Impacto	
3	Catastrofico	
2	Moderado	
1	Insignificante	

4.- Revisados los pliegos y términos de referencia se establece en la forma de pago y condiciones, que la EP-CONST pagará en el último mes del contrato al Aliado Estratégico la cantidad de ..., más la diferencia de los meses que el privado aportó económicamente con el proyecto es decir del mes 1, 2, 3, 4, 5, y 6, para lo cual el Administrador del Contrato deberá realizar una reliquidación en base a las toneladas recogidas y/o tratadas durante el tiempo de ejecución del contrato. ¿Solicito se sirvan aclarar cual es la diferencia entre este proceso y un proceso seguido mediante el Sistema Nacional de Contratación Pública? Es importante en este punto señalar que la Asamblea Nacional ha aprobado el tipo penal de elusión de procedimiento de contratación, cuando una entidad busca evadir el camino de un proceso que a todas luces es regulado por la LOSNCP, por otra figura.

Rta. El artículo 35 de la Ley Orgánica de Empresas Públicas señala que " *Las empresas públicas tienen capacidad asociativa para el cumplimiento de sus fines y objetivos empresariales y en consecuencia para la celebración de los contratos que se requieran, para cuyo efecto podrán constituir cualquier tipo de asociación, alianzas estratégicas, sociedades de economía mixta con sectores públicos o privados en el ámbito nacional o internacional o del sector de la economía popular y solidaria, en el marco de las disposiciones del artículo 316 de la Constitución de la República.*

El artículo 42 de la Ley Orgánica de Empresas Públicas determina que " *Las empresas públicas sus subsidiarias y filiales podrán adoptar las formas de financiamiento que estimen pertinentes para cumplir sus fines y objetivos empresariales, tales como: ingresos provenientes de la comercialización de bienes y prestación de servicios así como de otros emprendimientos; rentas de cualquier clase que produzcan* *los activos, acciones, participaciones; acceso a los mercados financieros, nacionales o internacionales, a través de emisión de obligaciones, titularizaciones, contratación de créditos; beneficio de garantía soberana; inyección directa de recursos estatales, reinversión de recursos propios; entre otros"*

La capacidad asociativa de las Empresa Públicas, permiten iniciar procesos bajo los cuales no se tiene el financiamiento total, y sobre los cuales se debe contar con una fuente de repago a futuro para asegurar la inversión del privado para el cumplimiento de sus fines y objetivos; y garantizar la prestación de sus servicios públicos.

La Ley Orgánica del Sistema Nacional de Contratación Pública en su artículo 24 indica que *Las entidades previamente a la convocatoria, deberán certificar la disponibilidad presupuestaria y la existencia presente o futura de recursos suficientes para cubrir las obligaciones derivadas de la contratación"* al contar con una partida que no cumple el monto total del proyecto y al no tener una certificación futura de los fondos, bajo la capacidad asociativa y las formas de financiamiento de las empresas públicas se realiza bajo la modalidad de alianza estratégica para obtener el financiamiento de los 6 primeros meses del proyecto.

5.- Revisados los pliegos y términos de referencia se establece que no existe reajuste de precio y que el contratista debe renunciar al mismo, pero párrafo abajo se establece una formula polinómica.¿Sírvanse aclarar si va a existir reajusto o no, acorde a los señalado?

Rta. En efecto no existe reajuste de precios, por lo tanto, no existe fórmula polinómica, sin embargo, se establece una formula con un término que busca mantener el equilibrio económico en función de las publicaciones oficiales del INEC, para no generar ningún perjuicio al Aliado Estratégico.

6.- Revisados los pliegos y términos de referencia se establece 17 experiencia general, párrafo cuarto: "De igual manera para los profesionales que participan individualmente, será acreditable la experiencia adquirida en relación de dependencia, ya sea en calidad administrador, o cargos afines de acuerdo a la invitación y su valoración cuando gire en torno a los montos contractuales, se cumplieran considerando el 40% del valor del contrato en el que tales profesionales participaron en las calidades que se señalaron anteriormente."Más allá de los errores de redacción, solicitamos se sirvan aclarar lo siguiente:

•Que es un cargo "afín" de acuerdo a la invitación¿?; el mensajero de una empresa con el fin puede cumplir el requisito.

Rta. Respecto al párrafo en mención cargos afines hace referencia a Administrador del Contrato, Gerente de Proyectos, Administradores técnicos de proyectos, superintendentes que han participado en actividades relacionadas a la gestión de residuos sólidos tanto en el ámbito público como en el privado, el texto debe ser analizado de manera integral, por lo tanto, no hace referencia al mensajero de la empresa ni a cargos que no tengan relación con lo solicitado.

•Que se debe entender por "su valoración cuando gire en torno a los montos contractuales, se cumplieran considerando el 40% del valor del contrato en el que tales profesionalesparticiparon"si el profesional "afín" (indeterminable, mensajero o conserje) con un sueldo máximo de mil dólares, por cuanto su patrono tuvo un contrato de 20 millones, este personaje podrá acreditar 8 millones como experiencia?

Rta. El 40 % hace referencia al monto total del contrato presentado como experiencia, siempre y cuando su participación se relacione como Administrador del Contrato, Gerente de Proyectos, Administradores técnicos de proyectos, superintendentes que han participado en actividades relacionadas a la gestión de residuos sólidos tanto en el ámbito público como en el privado

•Cuanto años de relación de dependencia le acreditarán al trabajador la experiencia del patrono? UN mes, dos meses, todo el monto del contrato?

Rta. Deberá cumplir el tiempo mínimo que se justifique con el 40 % más de avance del proyecto que se presenta como experiencia

Las preguntas nacen en función de lo inentendible de dicho párrafo, pues un trabajador de quien TUVO el contrato, no puede acreditar la experiencia de dueño del contrato, puede probar su experiencia para personal asignado, pero no para "Aliado Estratégico".

7.- Revisados los pliegos y términos de referencia que financiamiento se espera del Aliado Estratégico, si al final, conforme los pliegos punto 12 igual le van a pagar los montos no cobrados?

Rta. En la forma de pago se estableció los aportes que hace el Aliado Estratégico privado mensualmente cuya liquidación se realizará en el último mes de trabajo, adicionalmente a los trabajos ordinarios de gestión integral de la basura el Aliado debe incrementarnos una herramienta tecnológica que será de uso exclusivo de la EP-CONST y que será entregado por el Aliado al final para su uso futuro, también será necesario implementar por parte del Aliado Estratégico equipos que permitan un reciclaje de ciertos materiales, deberá el Aliado suministrar, instalar y operar dichos equipos durante el periodo del contrato y al final pasara a ser un bien de la EP-CONST.

8.- Revisados los pliegos y términos de referencia no se solicita equipo NUEVO, sino que puede tener hasta una vida útil de máximo 12 años; es decir, se espera prestar el servicio de recolección con equipos viejos?

Rta. En razón de que el tiempo de ejecución del contrato está ligado al valor de la partida económica existente a la fecha de la convocatoria solo se establece un año de intervención lo cual limitaría a muy pocos participantes que puedan obtener o tener equipos nuevos la posibilidad de entregar una oferta, por lo que se da la alternativa de usar equipos usados que deberán ser previamente verificados por los técnicos de la empresa y aprobados para su uso.

9.- Revisados los pliegos y términos de referencia se establece una declaración juramentada de, en caso de ser adjudicado, contar con los recursos económico para ejecutar el proceso.¿Cual es el motivo de dicha declaración, si conforme el numeral 12 de los términos de referencia más la diferencia de los meses que el privado aportó económicamente con el proyecto es decir del mes 1, 2, 3, 4, 5, y 6, para lo cual el Administrador del Contrato deberá realizar una reliquidación en base a las toneladas recogidas y/o tratadas durante el tiempo de ejecución del contrato será cancelada al Adjudicatario?

Rta. Con la declaración juramentada se busca garantizar los recursos económicos para la debida ejecución del contrato, le recordamos que el pago se hará en función del trabajo efectivamente realizado.

OFERENTE: ECONCOSA S.A.
DÍA: 18-12-2020
HORA: 16H39

1.- Cual es el criterio técnico bajo el cual se requiere tener un patio de operaciones de 30.000m2 y un taller techado de 1.800m2? Por qué las cantidades desproporcionadas, en cuanto al tamaño de la flota vehicular?

Rta. En base a la experiencia que mantenemos y al modelo de circulación interna mas adecuado para garantizar que las actividades internas se las realice de manera adecuada.

2.- ¿Se puede indicar la cantidad de toneladas de materia orgánica que se procesarán para la elaboración de el Compost?

Rta. La cantidad de toneladas para la elaboración de compostaje se lo determinara una ves iniciado los planes pilotos de separación en la fuente.

3.- ¿En qué vehículos y de que lugares de la ciudad de Santo Domingo se realizará la recolección diferenciada de los desechos orgánicos?

Rta. El aliado estratégico con su equipo de educación ambiental deberá de implementar en los primeros 30 días después del inicio de operaciones un plan de trabajo donde especifique lugares y frecuencias donde se iniciarán el plan piloto de la recolección diferenciada y este debe ser aprobado por el administrador del contrato. Este servicio lo brindará el aliado estratégico sin que represente un incremento a la tarifa por el servicio de recolección, transporte y disposición final de desechos sólidos en el cantón santo domingo. Y los vehículos serán los q se estipularon en los Términos de Referencia.

4.- ¿Con que maquinaria, equipos e instalaciones cuenta la EP-CONST para el manejo de los desechos orgánicos y elaboración de compost?

Rta. El Complejo Ambiental cuenta con un área destinada para el proceso de elaboración de compost que incluye las fases de fermentación y deshidratado. Además de otra área donde se encuentra la máquina que realiza el proceso de tamizaje y ensacado.

5.- ¿Cuenta la EP-CONST con el área de almacenamiento, maquinaria para la carga y el traslado de materiales como el aserrín para la elaboración de las camas para la composta, quien correrá con los costos para la adquisición de este material?

Rta. La EP-CONST si cuenta con un área de almacenamiento de compost. La maquinaria para carga y traslado de materiales como el aserrín para la elaboración de las camas para la composta, se encuentran detalladas en el equipo mínimo solicitado en los Términos de Referencia. La elaboración del compost estará a cargo del aliado estratégico, por lo que los costos de adquisición de materiales e insumos correrá a cargo del mismo.

6.- ¿Cuenta la EP-CONST con la metodología para el funcionamiento de la planta Físico-Químico para el tratamiento de Lixiviados, podría facilitarse al Aliado Estratégico esta Información?

Rta. La EP-CONST si cuenta con la metodología para el funcionamiento de la planta Físico-Químico para el tratamiento de Lixiviados, la información se le facilitará al aliado estratégico seleccionado

7.- ¿Desde la adquisición y funcionamiento de la planta Físico-Químico se debe tener datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados, podría facilitarse esa información al interesado con la finalidad de realizar un adecuado calculo del costo de operacion y proyeccin de efluentes?

Rta. La EP-CONST si cuenta con datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados de la planta Físico-Químico, la información se le facilitará al aliado estratégico seleccionado

8. ¿La EP-CONST cuenta con técnicos especializados en el funcionamiento de la planta VSEP, de tal forma que previo al inicio de operaciones en el complejo ambiental por el Aliado estratégico, puedan dar una inducción completa de la operatividad de la planta VSEP?

Rta. Si, la EP-CONST cuenta con técnicos especializados en el funcionamiento de la planta VSEP, de tal forma que previo al inicio de operaciones en el complejo ambiental por parte del Aliado Estratégico, se programará una inducción completa de la operatividad de la planta VSEP

9. ¿Cuenta la EP-CONST con datos históricos de rendimientos y producción por metros cúbicos de lixiviados tratados?

Rta. La EP-CONST si cuenta con datos recopilados sobre el rendimiento y producción para el tratamiento de los lixiviados de la planta Físico-Químico.

10. ¿Qué insumos y cuantos mantenimientos se le debe realizar a la planta VSEP?

Rta. La información de los insumos químicos que se utilizan en la planta V-SEP será entregada al aliado seleccionado.

La planta se entregará en estado funcional y operativo para un año. Si en caso de ocurrir un desperfecto ocasionado por la operación del aliado estratégico este asumirá los costos de reparación mantenimiento e insumos según corresponda.

Para mayor información de la planta V-SEP, revisar el anexo 1.

11. ¿Cuenta la EP-CONST con los costos operativos de la Planta VSEP?

Rta. Si, la EP-CONST cuenta con los costos operativos de la Planta VSEP

12. ¿hay en el país representante o distribuidor autorizado que provea los insumos consumibles de la plata VSEP?

Rta. En Ecuador existe un proveedor único, representante de la empresa fabricante de la planta, mismo que se encarga del mantenimiento, repuestos y operatividad de la planta V-SEP.

13. Se solicita proporcionar informacion del modelo y especificaciones tecnicas d ela planta VSEP y de los consumibles para poder costear su recambio e incluir en presupuesto de operacion.

Rta. La información de los insumos químicos que se utilizan en la planta V-SEP será entregada al aliado seleccionado.

La planta se entregará en estado funcional y operativo para un año. Si en caso de ocurrir un desperfecto ocasionado por la operación del aliado estratégico este asumirá los costos de reparación mantenimiento e insumos según corresponda.

Para mayor información de la planta V-SEP, revisar el anexo 1.

14. ¿Puede el Aliado estratégico presentar a la EP-CONST una nueva propuesta para el tratamiento de Lixiviados en el caso que con otro sistema se obtenga mejores niveles de rendimiento y producto tratado?

Rta. Si, el oferente puede presentar una nueva propuesta, pero la EP-CONST bajo criterio técnico propio determinará si es viable o no cambiar los métodos de tratamiento.

15. ¿En base a que metodología se calificará el estado y manejo de las instalaciones del Complejo Ambiental?

Rta. Una vez seleccionado el aliado estratégico se calificará el estado y manejo del complejo ambiental en base a los indicadores comparativos con datos actuales y respetando las obligaciones establecidas por el aliado estratégico en los Términos de Referencia; bajo ninguna circunstancia se podrá paralizar este servicio.

16. Que garanti ofrece la EP-CONST de que las plantas primarias y VSEP para tratamiento de lixiviados estanran en optimas condiciones de operacion, al inicio de labores del aliado estrategico?

Rta. Las plantas primarias y VSEP para tratamiento de lixiviados estarán en optimas condiciones de operación.

17. Quien correra con los costos de las adecuaciones, reparaciones y/o repotenciaciones necesarias en las plantas de lixiviados para su optimo funcionamiento, en caso de necesitarse, para el inicio de operaciones del aliado estrategico?

Rta. La EP-CONST entregará en el inicio de operaciones los equipos del complejo ambiental en estado funcional y operativo, de suscitarse algún evento futuro en la operación de los mismos, será responsabilidad del aliado estratégico el mantenimiento necesario.

18. ¿Deberá el Aliado estratégico bajo su criterio presentar un cronograma valorado de actividades para socializarlo con la EP-CONST y previa planificación sustentada y documentada implementar un plan de visitas a las instalaciones del Complejo Ambiental?

Rta. El Aliado Estratégico si deberá presentar un cronograma valorado de actividades como parte de la metodología que es un componente de la oferta que deberán presentar.

Respecto al cronograma de vistas no será necesario, ya que el personal de la EP-CONST tendrá libre acceso a las instalaciones del complejo ambiental las 24 horas del día y los 365 días del año.

19. ¿Cuenta la EP-CONST con las instalaciones y suficiente superficie (Espacio Físico) para implementar un sistema de fitorremediación, considerando que hay un tiempo determinado para que cada especie bio-acumule y considrando que la planta de tratamiento primario siempre va a ser retroalimentada con Lixiviados crudos?

Rta. El complejo ambiental si cuenta con un espacio físico para implementar un sistema de fitorremediación.

20. ¿Cuentan con estudios para la implementación del sistema de Fitorremediación?

Rta. Si se cuentan con estudios para la implementación del sistema de Fitorremediación

21. ¿Tiene la EP-CONST la metodología a implementarse para el sistema de fitorremediación, en el caso que sea positivo se le facilitaría al Aliado Estratégico esta información?

Rta. Si se cuenta con la metodología para la implementación del sistema de fitorremediación. La información se entregará al Aliado Estratégico seleccionado.

22. ¿Tiene la EP-CONST análisis de las piscinas primarias, características de los Lixiviados crudos que ingresan al sistema primario, los pre tratados para la fase del sistema de fitorremediación, en especial la presencia y concentración de metales pesados?

Rta. La EP-CONST si cuenta con el análisis de las piscinas primarias, características de los Lixiviados crudos que ingresan al sistema primario, los pre tratados para la fase del sistema de fitorremediación.

23. ¿Tiene datos específicos la EP-CONST de los Pasivos Ambientales que generaría este sistema de Fitorremediación?

Rta. La EP-CONST si cuenta con datos específicos de los Pasivos Ambientales que generaría el sistema de Fitorremediación.

24. ¿Cuenta la EP-CONST con un plan emergente, de acción y cierre para el sistema de Fitorremediación?

Rta. La EP-CONST si cuenta con un plan emergente de acción y cierre para el sistema de Fitorremediación

25. ¿Podrá el Aliado estratégico bajo su criterio sustentando técnicamente, desistir de manejar tal sistema o en el mejor de los casos seleccionar bajo su criterio una mejor alternativa?

Rta. El aliado estratégico deberá cumplir con lo establecido en los Términos de Referencia

26. ¿Tiene la EP-CONST datos sobre las cantidades de EM que se deben utilizar dentro del Complejo Ambiental?

Rta. La EP-CONST cuenta con información de los productos que se han utilizado en el complejo ambiental en los últimos años, sin embargo, la cantidad de EM (Microrganismos Eficientes) dependerá del producto que el oferente presente en su propuesta.

27. ¿Podría especificar en cual de todos los procesos que se van a realizar dentro de el Complejo Ambiental o en el Servicio de Recolección se utilizarían los EM?

Rta. Los EM (Microrganismos Eficientes) se utilizarán en todos los procesos dentro del complejo ambiental.

28. ¿Podrá el Aliado Estratégico bajo su criterio elaborar un cronograma Valorado para realizar el control de plagas en el Complejo Ambiental?

Rta. El Aliado Estratégico si podrá elaborar un cronograma valorado para realizar el control de plagas en el Complejo Ambienta, pero este debe ser revisado y aprobado por la EP-CONST.

29. ¿Puede explicar por qué el Aliado Estratégico deberá coordinar la adquisición de insumos con la Dirección de Saneamiento y Gestión Ambiental?

Rta. En virtud que la EP-CONST es la entidad contratante, que administra y fiscaliza el cumplimiento del servicio, es indispensable que se coordine con ella la adquisición de insumos, con la finalidad de verificar su origen y funcionabilidad.

30. ¿Cuenta la EP-CONST con los equipos para la trituración de llantas?

Rta. Para el efecto deberá referirse al literal 9.5 pagina 46 de los Términos de Referencia.

31. ¿Podría el Aliado estratégico mediante un gestor autorizado entregar estos desechos?

Rta. El aliado estratégico no podrá entregar los desechos de llantas a una tercera persona.

32. ¿Cuenta la EP-CONST con áreas destinadas para el almacenamiento de equipos y maquinarias?

Rta. La EP-CONST si cuenta áreas destinadas para el almacenamiento de equipos y maquinarias

33. ¿Dentro de los TDR´s no se considera personal en el área de mecánica y soldadura ni sus ayudantes tanto para el funcionamiento del Complejo Ambiental como para el servicio de recolección ayudantes? Así mismo no cuentan con un área de lavado y desinfección de los equipos tampoco se está considerando un jefe de talleres y mucho menos el personal para realizar el barrido dentro de la ciudad, tampoco se considera personal para el manejo del Laboratorio, área de compostaje, planta se separación, área de tamizaje y mucho menos los profesionales en el área ambiental, química, médica y legal.

Rta. Los Términos de Referencia en el numeral 6. contemplan el personal mínimo para la prestación del servicio, en caso de que el oferente considere necesario presentar en su oferta personal adicional, esto no afectará el valor contractual.

34. Bajo que criterio tecnico se requiere que las instalaciones administrativas, operativas, talleres, y otras se encuentren fuera del limite urbano?

Rta. Con la finalidad de cumplir con la normativa legal vigente.

35. Cual es el limite urbano de la ciudad de Santo Domingo?

Rta. Para verificar cual es el límite urbano de la ciudad de Santo Domingo, remitirse al Plan de Desarrollo y Ordenamiento Territorial vigente.

36. El registro ambiental requerido para la recoleccion de desechos no puede ser iniciado su tramite sino hasta el inicio de operaciones del aliado estrategico, que plazo se dara para obtenerlo, luego de iniciadas las labores?

Rta. El oferente deberá de contar con los documentos solicitados para la presentación del presente proceso.

37. La EP-CONST asume la responabilidad por pasivos ambientales ocultos existentes a la fecha en el complejo ambiental?

Rta. En caso de existir pasivos ambientales en el Complejo Ambiental, la EP-CONST asumirá esta responsabilidad.

38. Quien corre con el costo de los seguros por responsabilidad de daños ambientales que se produzcan el complejo ambiental?

Rta. El costo de los seguros por responsabilidad de daños ambientales que se produzcan en el Complejo Ambiental correrán por cuenta del Aliado Estratégico.

39. La construccion y operacion de los cubetos se iniciara en aquel que estuviere en uso al momento del inicio de labores, o se designara nuevas areas para que las intervenga el aliado estrategico?

Rta. La operación del manejo de desechos sólidos se realizará en el cubeto que se encuentre habilitado actualmente y la construcción de los nuevos cubetos se la realizará en coordinación con el administrador del contrato.

40. La Ep-CONST asume la responsabilidad, incluida la ambiental, por las operaciones y trabajos que se hayan realizado con anterioridad al inicio de labores del aliado estrategico?

Rta. El costo por las operaciones y trabajos que se hayan realizado con anterioridad al inicio de labores del Aliado Estratégico serán responsabilidad de la EP-CONST.

OFERENTE: ECONCOSA S.A.
DÍA: 18-12-2020
HORA: 16H46

1.- ¿Cuenta la EP-CONST con directrices para el desarrollo del Programa de Educación Ambiental para la separación en la fuente?

Rta. Las directrices para el desarrollo del programa de Educación Ambiental para la separación en la fuente se deberá cumplir con lo estipulado en los Términos de Referencia en el numeral 9.3 pagina 46.

2.- ¿En los TDR´s tampoco se especifica el equipo técnico para el proyecto de separación en la fuente dentro de la ciudad y cuáles serían los materiales a utilizarse?

Rta. Las directrices del equipo técnico para el proyecto de separación en la fuente dentro de la ciudad están estipuladas en los Términos de Referencia en el numeral 9.3 pagina 46.

3.- ¿Cuenta la EP-CONST con información base de proyectos realizados en años o administraciones anteriores y cuales han sido los resultados, en caso que sea positiva la respuesta, esta información podrá ser entregada al Aliado Estratégico?

Rta. La EP-CONST si cuenta con información base de proyectos ejecutados en el Complejo Ambiental, y de ser pertinente la información será entregada al Aliado Estratégico seleccionado.

4.- ¿Quién llevará a cabo y a costo de quien estará las especies a sembrar en las riberas de los ríos?

Rta. En los Términos de Referencia no se encuentra estipulado la siembra en las riberas de los ríos.

5.- ¿Cuenta la EP-CONST con un levantamiento de información de los lugares a reforestar y de ser así, cuantos son y de qué área (m2)?

Rta. En los Términos de Referencia no se encuentra estipulado la siembra en las riberas de los ríos.

6.- ¿Cuáles serian las especies a utilizarse?

Rta. En los Términos de Referencia no se encuentra estipulado la siembra en las riberas de los ríos.

7.- ¿Cuánto sería el personal necesario para el proceso de reforestación en las riveras de los ríos?

Rta. En los Términos de Referencia no se encuentra estipulado la siembra en las riberas de los ríos.

8.- ¿Dentro de los TDR´s se menciona que los funcionarios de la EP-CONST controlará ubicación, recorrido, funcionamiento etc de los servicios de recolección, transporte y barrido de los desechos sólidos de Santo Domingo, esto quiere decir que aparte de ya contar con un Administrador y Fiscalizador de contrato, los funcionarios de la EP-CONST pasarían a realizar el mismo rol. Especifique, cuantos Administradores y Fiscalizadores tendría este servicio, considerando que esta actividad es propia del Aliado Estratégico a seleccionarse.

Rta. En virtud que se han seleccionado 44 rutas diferentes que cubren toda la ciudad de Santo Domingo en su área urbana y rural, es necesario además de 1 Administrador y 1 Fiscalizador, contar con un equipo de inspectores que se encargaran de controlar la ubicación, recorrido y funcionamiento de los servicios de recolección, transporte y disposición final de los desechos sólidos de Santo Domingo.

4. CLAUSURA

Sin tener otro particular en la presente, la comisión técnica se ratifica en todo lo actuado.

Se dispone a la Unidad de Tecnología de la Información, publique la presente Acta de Preguntas Respuestas en el sitio web de la empresa pública EP-CONST www.epconst.gob.ec.

El presidente, dispone convocar a los miembros de la Comisión Técnica a la apertura de ofertas para el día miércoles 30 de diciembre de 2020.

Siendo las 17h30, se da por concluido el presente acto, para constancia de todo lo actuado suscriben los miembros de la Comisión técnica que han intervenido en la presente diligencia.

Ing. Mauro Paul Viñan Andino
PRESIDENTE DE LA COMISIÓN TÉCNICA

Mv. Ider David Alcívar Angueta
TITULAR DE ÁREA

Pedro Calderón

Ing. Pedro Fernando Calderón Reascos
PROFESIONAL RELACIONADO CON EL PROCESO

Marian Cadena

Abg. Marian Carolina Cadena Sarmiento
PROCURADORA SÍNDICA CON VOZ INFORMATIVA

Nota: La secretaria redactó el acta de conformidad a la información entregada por la Comisión Técnica.

Ing. Stephanie Tamara Sandoval Yanchaliquín
SECRETARIA

ANEXO 1

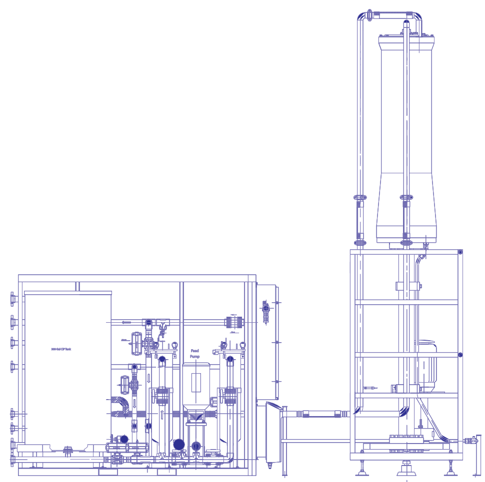
A New Standard in Rapid Separations

MADE IN U.S.A.

V✧SEP Engineering Documentation

V✧SEP© Series i

Process Engineering Binder



Proyecto: Planta de Tratamiento de Lixiviados del Complejo Ambiental de Santo Domingo de los Tsachilas

Jefe de Proyecto: Christian Lemos - Ernesto Bastidas

Locacion: Santo Domingo, Ecuador

Aplicacion: Lixiviado de Relleno Sanitario

Relleno Sanitario Santo Domingo de los Tsachilas

Fabricante:

New Logic Research
1295 67th Street, Emeryville, CA 94608 USA
510-655-7305 tel, 510-655-7307 fax
info@vsep.com (e-mail); www.vsep.com (http)

Cliente:

Global Fluids
Quito-Ecuador
Consorcio E y E
Complejo Ambiental de Santo Domingo
de los Tsachilas, Ecuador

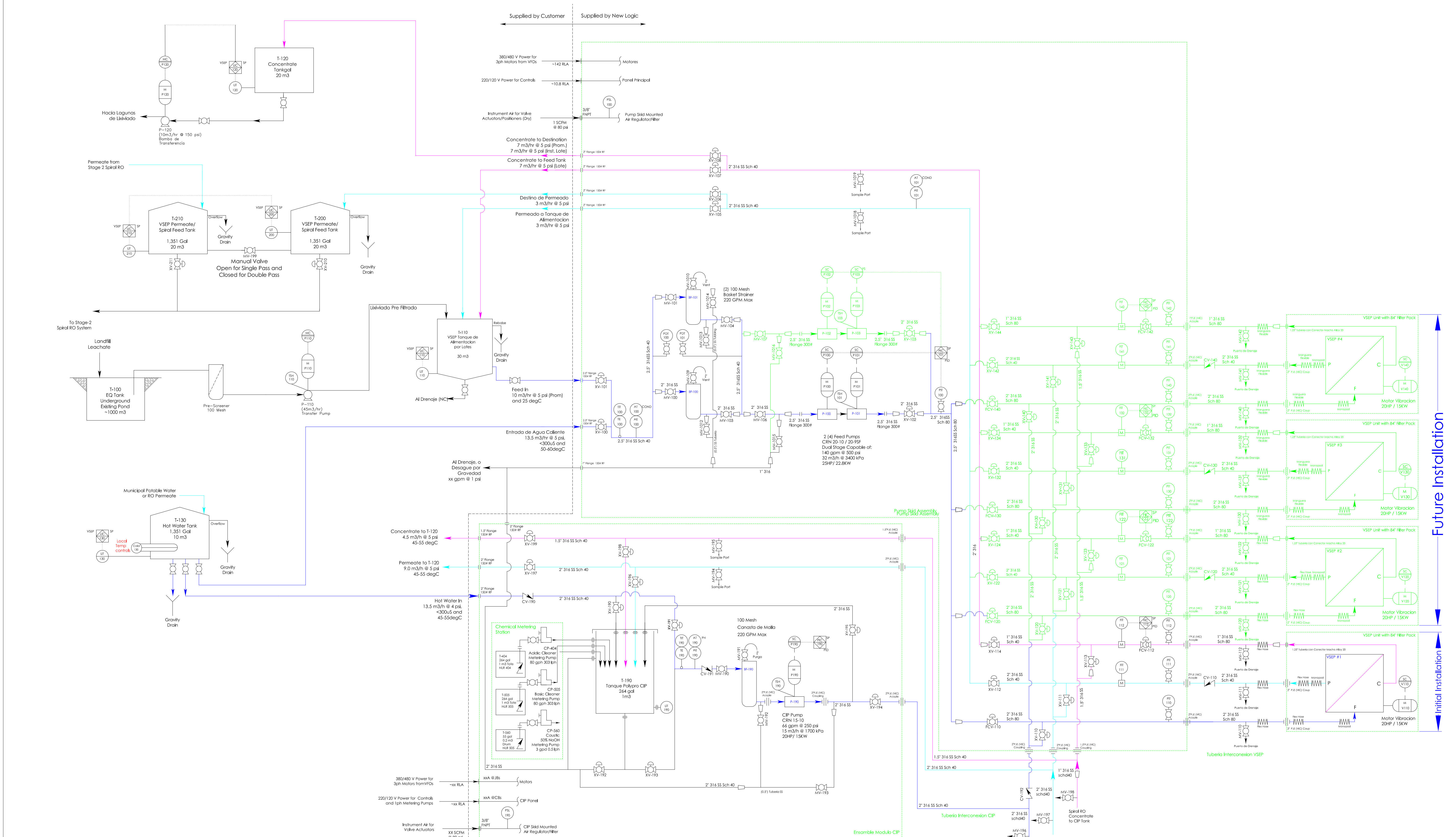
Relleno Sanitario
Santo Domingo
de los Tsachilas

Consorcio
E y E

Process Engineering

INDEX

1	P&ID & Project Info
2	Process & System Info
3	Control System Summary
4	Preliminary Electrical Info
5	Control Strategy
6	Membrane Cleaning
7	Instruments Spreadsheet and Cut Sheets
8	Valves Spreadsheet and Cut Sheets
9	Pumps Spreadsheet and Cut Sheets
10	Tanks Spreadsheet and Cut Sheets
11	Certificates & Procedures
12	Engineering References



Customer Components Provided:

1] Tanks with associated equipment
2] Levels and other Instruments
3] Transfer Pumps and motor starters
4] Hot Water Tank or In-Line Heaters
5] Sump with associated equipment
6] Valves and Piping
7] Electrical Load Pannel, CBs, and Generator or Transformer
8] Crane or Lift
9] Catwalk or Ladder
10] Plant Air or Compressor
11] Other equipment as recomended

Supplied by Customer | Supplied by New Logic

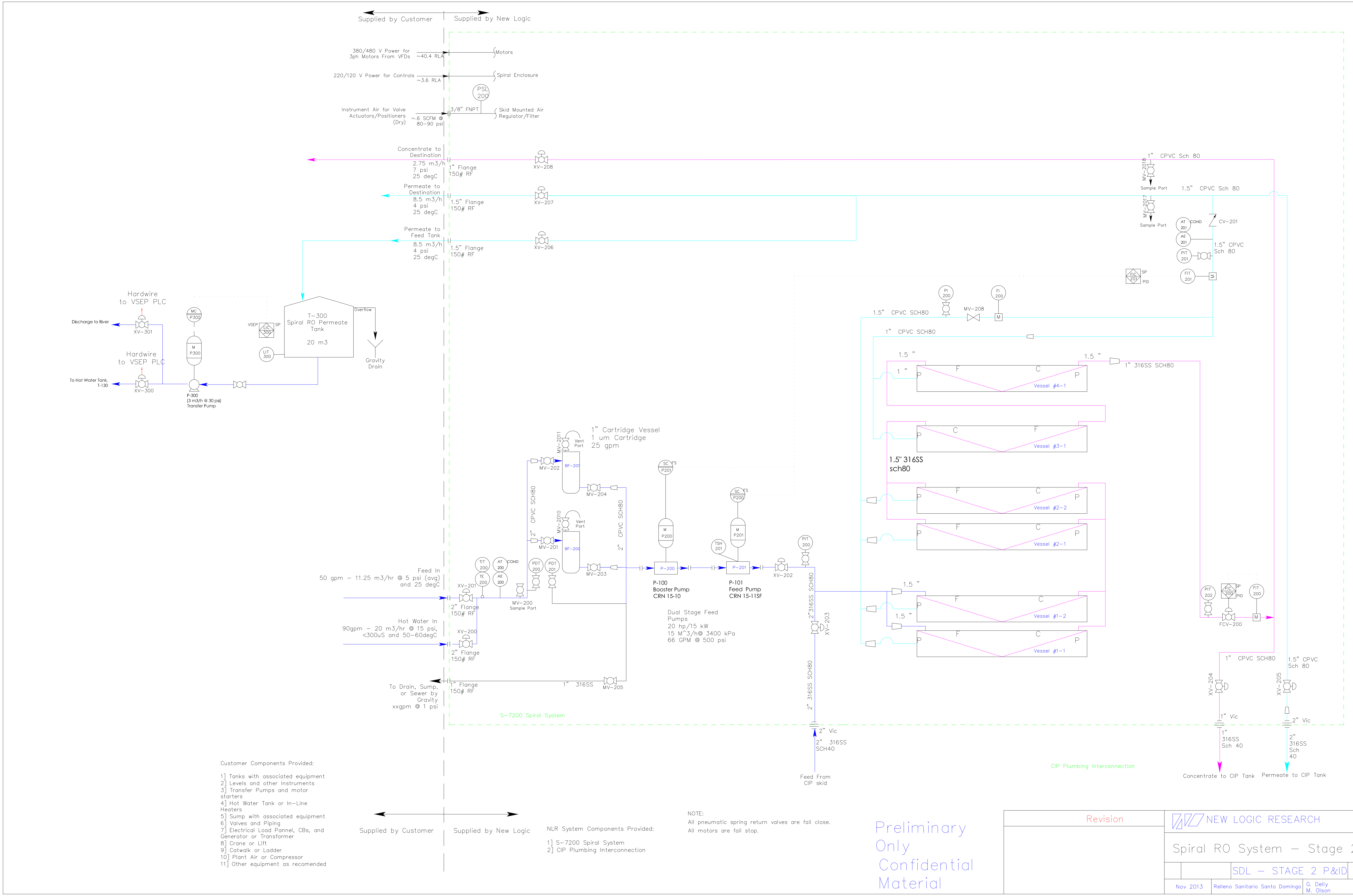
NLR System Components Provided:

1] 2x VSEP Unit with 84" Filter Pack
2] Pump Skid Assembly
3] VSEP Plumbing Interconnection
4] CIP Plumbing Interconnection
5] CIP Skid Assembly
6] Chemical Metering Station

NOTE:
All pneumatic spring return valves are fail close.
All motors are fail stop.

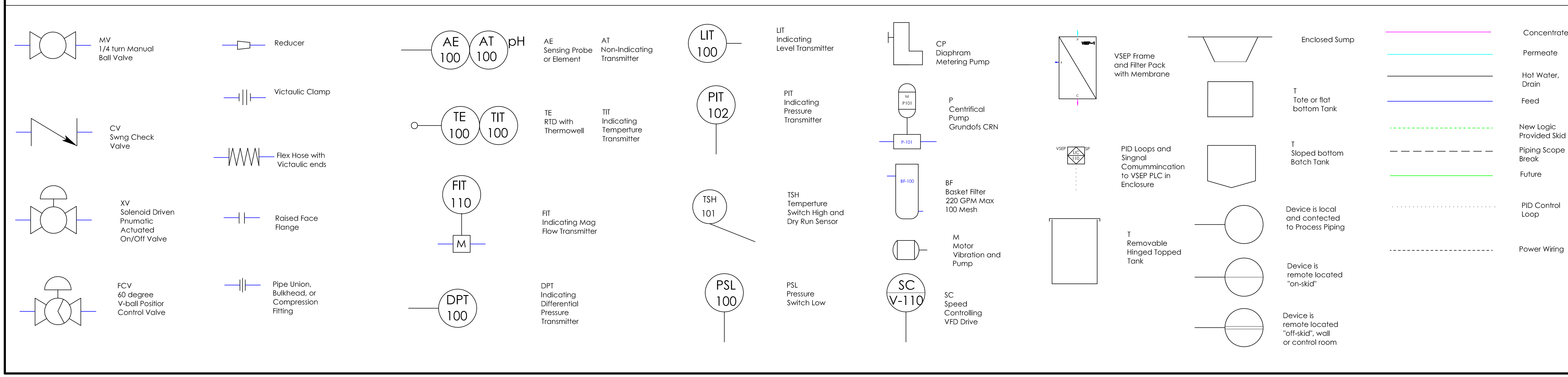
Plano Preliminar
Material Confidencial

Revision	NEW LOGIC RESEARCH
	84" Multiple Module System (4 Modulos)
	SDL STG 1 P&ID
	DEC 2013 — Relleno Sanitario Santo Domingo — M. Olson, G. Delly



Supplied by Customer
Supplied by New Logic
380/480 V Power for 3ph Motors From VFDs
~40.4 RLA
Motors
220/120 V Power for Controls
~3.6 RLA
Spiral Enclosure
PSL 200
Instrument Air for Valve Actuators/Positioners (Dry)
~.6 SCFM @ 80-90 psi
3/8" FNPT
Skid Mounted Air Regulator/Filter
Concentrate to Destination
2.75 m3/h
7 psi
25 degC
1" Flange 150# RF
XV-208
Permeate to Destination
8.5 m3/h
4 psi
25 degC
1.5" Flange 150# RF
XV-207
Permeate to Feed Tank
8.5 m3/h
4 psi
25 degC
1.5" Flange 150# RF
XV-206
1" CPVC Sch 80
MV-2018
Sample Port
1.5" CPVC Sch 80
MV-2017
Sample Port
CV-201
AT 201 COND
AE 201
PIT 201
1.5" CPVC Sch 80
FIT 201
FIC 201 SP PID
Hardwire to VSEP PLC
Discharge to River
XV-301
MC P300
M P300
VSEP LIC 300 SP
T-300
Spiral RO Permeate Tank
20 m3
Overflow
Gravity Drain
LIT 300
Hardwire to VSEP PLC
To Hot Water Tank, T-130
XV-300
P-300
(3 m3/h @ 30 psi)
Transfer Pump
PI 200
FI 200
1.5" CPVC SCH80
MV-208
1" CPVC SCH80
1.5 "
1.5 "
1" 316SS SCH80
1 "
Vessel #4-1
Vessel #3-1
1.5" 316SS sch80
Vessel #2-2
Vessel #2-1
1.5 "
1.5 "
Vessel #1-2
Vessel #1-1
1" Cartridge Vessel
1 um Cartridge
25 gpm
MV-2011
Vent Port
MV-202
BF-201
MV-204
MV-2010
Vent Port
MV-201
BF-200
MV-203
2" CPVC SCH80
2" CPVC SCH80
SC P201 FS
SC P200 FS
M P200
TSH 201
M P201
P-200
P-201
P-100 Booster Pump CRN 15-10
P-101 Feed Pump CRN 15-11SF
PIT 200
XV-202
2" 316SS SCH80
XV-203
2" 316SS SCH80
Dual Stage Feed Pumps
20 hp/15 kW
15 M^3/h@ 3400 kPa
66 GPM @ 500 psi
Feed In
50 gpm - 11.25 m3/hr @ 5 psi (avg) and 25 degC
TIT 200
TE 200
AT 200 COND
AE 200
PDT 200
PDT 201
XV-201
2" Flange 150# RF
MV-200 Sample Port
Hot Water In
90gpm - 20 m3/hr @ 15 psi, <300uS and 50-60degC
XV-200
2" Flange 150# RF
To Drain, Sump, or Sewer by Gravity
xxgpm @ 1 psi
1" Flange 150# RF
1" 316SS
MV-205
S-7200 Spiral System
PIT 202
FIC 200 SP PID
FIT 200
FCV-200
1" CPVC SCH80
1.5" CPVC Sch 80
XV-204
XV-205
1" Vic
1" 316SS Sch 40
2" Vic
2" 316SS Sch 40
2" Vic
2" 316SS SCH40
Feed From CIP skid
CIP Plumbing Interconnection
Concentrate to CIP Tank
Permeate to CIP Tank
Customer Components Provided:
1] Tanks with associated equipment
2] Levels and other Instruments
3] Transfer Pumps and motor starters
4] Hot Water Tank or In-Line Heaters
5] Sump with associated equipment
6] Valves and Piping
7] Electrical Load Pannel, CBs, and Generator or Transformer
8] Crane or Lift
9] Catwalk or Ladder
10] Plant Air or Compressor
11] Other equipment as recomended
Supplied by Customer
Supplied by New Logic
NLR System Components Provided:
1] S-7200 Spiral System
2] CIP Plumbing Interconnection
NOTE:
All pneumatic spring return valves are fail close.
All motors are fail stop.
Preliminary Only Confidential Material
Revision
NEW LOGIC RESEARCH
Spiral RO System - Stage 2
SDL - STAGE 2 P&ID
Nov 2013
Relleno Sanitario Santo Domingo
G. Delly
M. Olson

P&ID Symbols Legend



Notes:
NLR Confidential Material
For Reference Only.

Revision	NEW LOGIC RESEARCH
	P&ID Symbols Legend
	P&ID
	June 2012 — M. Ayers, G. Chauhan

ID		Task Name	Duration	Start	Finish	Predecessors
1		**SDL Project - Preliminary Timeline Summary**	**99 days**	**Tue 11/19/13**	**Fri 4/4/14**	
2						
3		**Planning**	**41 days**	**Tue 11/19/13**	**Tue 1/14/14**	
4		Received First Payment	1 day	Tue 11/19/13	Tue 11/19/13	
5		Create and Send out engineering drawings to customer	12 days	Wed 11/20/13	Thu 12/5/13	4
6		Customer receives&reviews eng documents.	12 days	Fri 12/6/13	Mon 12/23/13	5
7		Conference Call and Customer Returns Signoff sheets	0 days	Mon 12/23/13	Mon 12/23/13	6
8		Order final bill of materials.	1 day	Tue 12/24/13	Tue 12/24/13	7
9		Process/Drafting dept distributes final design pkg to manufacturing dept.	1 day	Tue 12/24/13	Tue 12/24/13	6
10		Receive materials.	15 days	Wed 12/25/13	Tue 1/14/14	8
11						
12		**Manufacturing**	**54 days**	**Tue 12/24/13**	**Fri 3/7/14**	
13		**Skid-1 (Pump Skid)**	**36 days**	**Wed 1/15/14**	**Wed 3/5/14**	
14		Cut skid metal	3 days	Wed 1/15/14	Fri 1/17/14	10
15		Weld the skid	3 days	Mon 1/20/14	Wed 1/22/14	14
16		Powder-coat skid frame	5 days	Thu 1/23/14	Wed 1/29/14	15
17		Cut & machine pipe	3 days	Mon 1/20/14	Wed 1/22/14	14
18		Tack weld pipe	3 days	Thu 1/23/14	Mon 1/27/14	17
19		Mock up pipe	3 days	Thu 1/30/14	Mon 2/3/14	18,16
20		Weld pipe	3 days	Tue 2/4/14	Thu 2/6/14	19
21		Fit up and electropolish the piping	7 days	Fri 2/7/14	Mon 2/17/14	20
22		Intrumentation and Electrical fabrication. Finish final fabrication	12 days	Tue 2/18/14	Wed 3/5/14	21
23		**Skid-2 (CIP)**	**35 days**	**Mon 1/20/14**	**Fri 3/7/14**	
24		Cut skid metal	1 day	Mon 1/20/14	Mon 1/20/14	14
25		Weld the skid	3 days	Thu 1/23/14	Mon 1/27/14	15
26		Powder-coat skid frame	5 days	Thu 1/30/14	Wed 2/5/14	16
27		Cut & machine pipe	1 day	Thu 1/23/14	Thu 1/23/14	17
28		Tack weld pipe	3 days	Tue 1/28/14	Thu 1/30/14	18
29		Mock up pipe	3 days	Thu 2/6/14	Mon 2/10/14	28,26
30		Weld pipe	4 days	Tue 2/11/14	Fri 2/14/14	29
31		Fit up and electropolish the piping	7 days	Mon 2/17/14	Tue 2/25/14	30
32		Intrumentation and Electrical fabrication. Finish final fabrication	8 days	Wed 2/26/14	Fri 3/7/14	31
33		**Skid-3 (IC pipe and metering pump station)**	**16 days**	**Fri 1/24/14**	**Fri 2/14/14**	
34		Cut skid metal	1 day	Fri 1/24/14	Fri 1/24/14	27
35		Weld the skid	1 day	Mon 1/27/14	Mon 1/27/14	34
36		Powder-coat skid frame	5 days	Tue 1/28/14	Mon 2/3/14	35
37		Cut tubing	1 day	Tue 2/4/14	Tue 2/4/14	36
38		Pumps and Electrical fabrication. Finish final fabrication	1 day	Wed 2/5/14	Wed 2/5/14	37
39		Cut & machine IC pipe	1 day	Fri 1/24/14	Fri 1/24/14	27
40		Tack weld IC pipe	2 days	Fri 1/31/14	Mon 2/3/14	28
41		Mock up IC pipe	1 day	Tue 2/4/14	Tue 2/4/14	40
42		Weld IC pipe	3 days	Wed 2/5/14	Fri 2/7/14	41
43		Fit up IC and electropolish the piping	5 days	Mon 2/10/14	Fri 2/14/14	42
44		metering skid and tubing	3 days	Mon 1/27/14	Wed 1/29/14	39
45		Filter Pack & VSEP fabrication and testing	8 wks	Tue 12/24/13	Mon 2/17/14	7
46		**Testing**	**16 days**	**Mon 3/10/14**	**Mon 3/31/14**	
47		System installed in wet test area	5 days	Mon 3/10/14	Fri 3/14/14	43,44,22,32,45
48		Load Program and Debug	5 days	Mon 3/17/14	Fri 3/21/14	47
49		Testing system in wet test area and carring out Quality Control	5 days	Mon 3/24/14	Fri 3/28/14	48
50		Customer Inspection and FAT	1 day	Mon 3/31/14	Mon 3/31/14	49
51						
52		**Packing and Shipping**	**4 days**	**Tue 4/1/14**	**Fri 4/4/14**	
53		Unistall system from wet test area	2 days	Tue 4/1/14	Wed 4/2/14	50
54		System is crated ready for pick up	2 days	Thu 4/3/14	Fri 4/4/14	53

NEW LOGIC RESEARCH
1295 67th Street Emeryville California 94608-1120 Phone: (510) 655-7305 Fax: (510)655-7307

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Matt Ayers – Engineering Manager/Project Manager
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Chip Johnson – VP Operations
(510) 655-7305 ext. 222, cjohnson@vsep.com
Julie Johnson – CFO
(510) 655-7305 ext. 202, julie@vsep.com

Wiring Instructions:
New Logic Research Inc
Account # 03-308376 RTN #
121000248 Walls Fargo Bank
N.A. 3640 Mt. Diablo Blvd.
Lafayette, CA U.S.A. 94549
SWIFT: WFBIUS6S

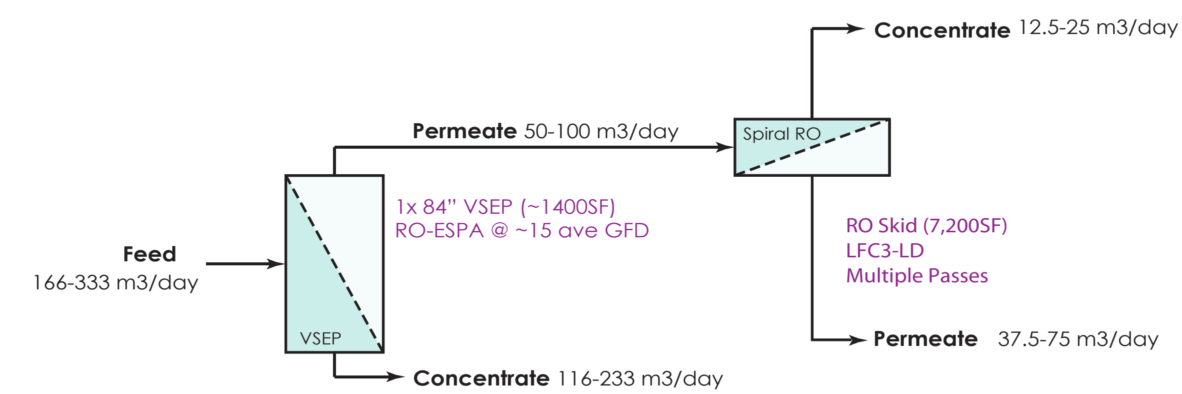
Filtration of Landfill Leachate

"Single Pass-Constant Flow" Process Flow Diagram

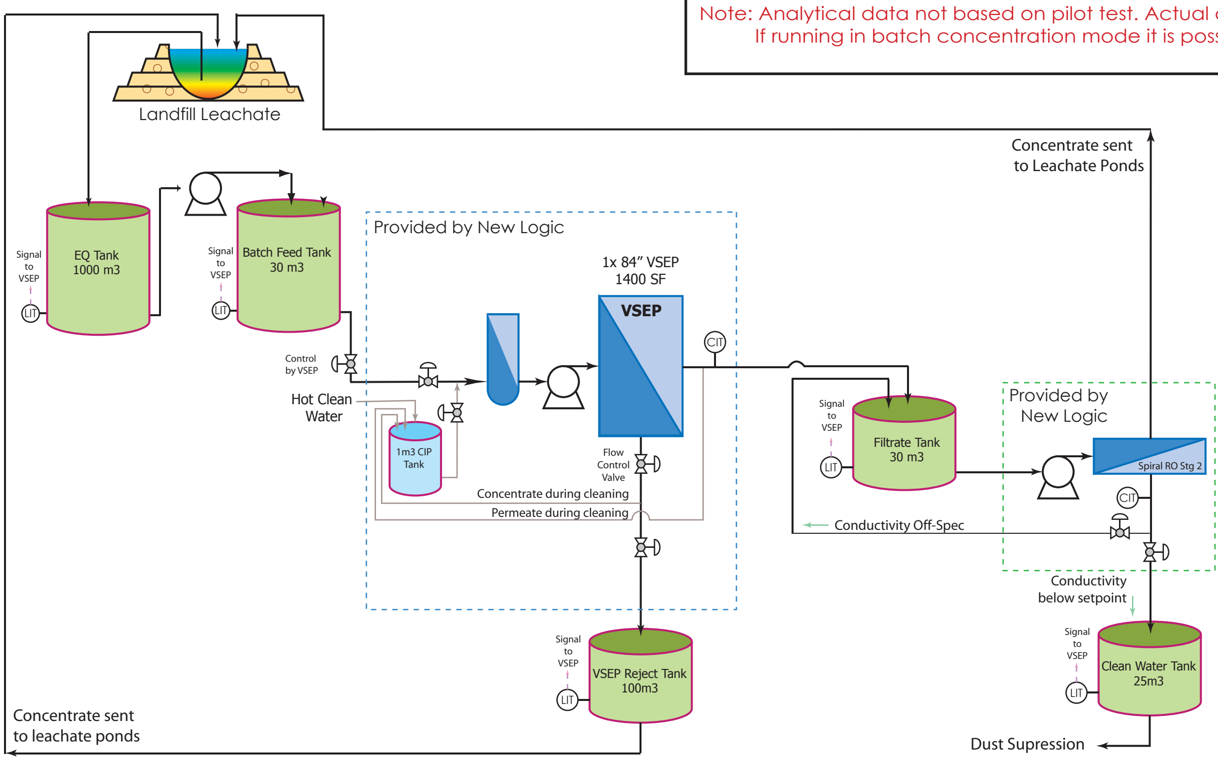
VSEP Advantages:
- Minimal/No Chemical Addition and Pre-Treatment
- Automated Controls
- Remote Monitoring
- Small Footprint
- Energy Efficient

Membrane: RO ESPA & Spiral LFC3-LD

Cleaning: NLR 404 & 505



Note: Analytical data not based on pilot test. Actual data may vary. Data shown based on SIngle Pass operation mode.
If running in batch concentration mode it is possible to reach 75% Recovery.



Controls:

The automatic VSEP process is controlled with a PLC. There are PID loops for the inlet pressure and concentrate flow rate. This is accomplished using VFD's and throttling valves, respectively. The filtration method available for use will be Single Pass-Constant Flow. This method is done by filling the feed tank and then running in filtration mode, removing permeate and concentrate from the batch feed tank as a single pass. The concentrate will be sent back to the leachate ponds. The feed tank level is maintained at a set point by the transfer pump.

After a system shut down due to low feed tank level, or after any shut down, the system would auto flush using hot water and then go into Stanby Mode. On start up after flushing with water, the discharge from the VSEP would go to drain for a set time interval until all water has been purged. Then the discharge from the VSEP diverts to the appropriate holding tanks. VSEPs will automatically clean at a predetermined timed interval.

Preliminary drawing for engineering discuision only. Please see P&ID for details.

NEW LOGIC Research
1295 67th Street, Emeryville, CA 94608 (510) 655-7305

Samto Domingo Landfill Leachate	11/20/2013
SDL Process Flow Diagram	

Utility Summary		New Logic Research
VSEP System	Rev:	A

AIR CONSUMPTION

	# of Valves	In^3 Air/stroke	Strokes/day	CFM	M3/hr
1 VSEP - Stage 1					
1" Pneumatic Valves	2	16.5	20	0.0003	0.0005
1.5" Pneumatic Valves	2	35	20	0.0006	0.0010
2" Pneumatic Valves	16	60	20	0.0077	0.0131
2.5" Pneumatic Valves	2	94	20	0.0015	0.0026
1" Flow Control Valves	1	35	20	0.5003	0.8505
2" Flow Control Valves	1	60	20	0.5005	0.8508
7200 Spiral - Stage 2					
1" Pneumatic Valves	2	16.5	20	0.0003	0.0005
1.5" Pneumatic Valves	3	35	20	0.0008	0.0014
2" Pneumatic Valves	4	60	20	0.0019	0.0033
1" Flow Control Valves	1	35	20	0.5003	0.8505
			System Totals	**1.51**	**2.574**

System Air Totals

Supply air to FCVs at 80-90 psi (560-630 kPa)

Supply air to Regulator/Filter at 80-90 psi 3/8" NPT Connection (CIP, Spiral, and Instrument Enclosure)

CLEANING WATER CONSUMPTION

(Use Hot Water for cleaning water >300 uS/cm)

	# /Day	Temp degC	Gallons/Day	GPM	M3/hr
1 VSEP Stage 1					
Cleanings (1 VSEP Modules)	1	50-60	1700	1.18	0.268
Rinse filter pack at 60gpm for 5mins	1	50-60	300	0.21	0.0473
Intermittent need of additional cleaning or flush of filter pack (Alarms)	0.14	50-60	42	0.03	0.0066
7200 Spiral - Stage 2					
Cleanings	0.14	50-60	294	0.20	0.05
Rinse, 80 gpm for 10mins	0.14	50-60	112	0.08	0.02
			System Totals	**1.70**	**0.3859**

System Water Totals

Supply water to at 20 psi 2" flange connection on CIP skid, 3" Pump Skid connection, and 2" Spiral Skid Connection

Supply Water at 50-60degC and 60gpm (13.5m3/hr)

ELECTRICAL CONSUMPTION

Based on 440 VAC, 3 phase, 60hz Input

FLA = Full Load Amps = Full Load Drive Output x 1.15x

RLA = Running Load Amps = FLA x .65x

VSEP 440 VAC Motors

	# Motors	HP /ea	kW /ea	Amps /ea	FLA /ea	RLA /ea	Total kW	Total FLA	Total RLA
1 VSEP Stage 1									
VSEP Drive Motor	1	20	15.2	27.0	31.1	20.2	15.2	31.1	20.2
VSEP Feed Pump	2	25	19.0	34.0	39.1	25.4	38.0	78.2	50.8
CIP Pump Motor	1	20	15.2	27.0	31.1	20.2	15.2	31.1	20.2
7200 Spiral - Stage 2									
Spiral Feed Pump	2	20	15.2	27.0	31.1	20.2	30.4	62.1	40.4
System Totals	**6**						**98.8**	**202.4**	**131.6**

Supply power to from customer supplied Load Pannel to a the VFD and then from VFD to each motor junction box

VSEP + Spiral 220 VAC									
Main Control Enclosures	4			4.8	5.5	3.6		22.1	14.4
Metering Pumps	2	0.75	0.6	4.8	5.5	3.6	1.1	11.0	7.2
System Totals	**6**						**1.1**	**33.1**	**21.5**
Supply power to circuit breakers in Main, CIP, and Spiral Enclosures									
Note:									
1. These are estimates only based on very preliminary data. These calculations are subject to change									
2. Off-skid equipment not included. Size larger transformer to include transfer pumps, lighting, and other offskid items.									

System Size Calculations

Landfill Leachate

V✧SEP®

V✧SEP® - Filtration is Finally an Option

			84" ESPA VSEP				8" LFC Spiral	
Given:								
Average Test Permeate Flux	15	GFD	26	LMH	5	GFD	9	LMH
% Recovery	30%		30%		75%		75%	
Feed Flow	44.30	GPM	10,061	LPH	13.29	GPM	3,018	LPH
Permeate Flow	13.29	GPM	3,018	LPH	9.97	GPM	2,264	LPH
Concentrate Flow	31.01	GPM	7,042	GPM	3.32		755	
Filter Size	1,400	SF	129	SM	400	SF	37	SM
Frequency of Cleanings	1	days	1	days	7	days	7	days
Length of Down Time for Cleaning	2	hours	2	hours	2	hours	2	hours
Frequency of Maintenance	7	days	7	days	31	days	31	days
Length of Down Time for Maintenance	1	hours	1	hours	1	hours	1	hours
Number of 5 minute flushes/day	0	ea	0	ea	0	ea	0	ea
Overdesign to account for Flux sag	30%		30%		50%		50%	
Calculated Values from Data Above								
Requested Production (Feed)	63,792	gpd	241,453	lpd	19,138	gpd	72,436	lpd
Permeate Production	19,138	gpd	72,436	lpd	14,353	gpd	54,327	lpd
Hours/day of filtration operation	21.9	hours	21.9	hr	23.7	hours	23.7	hr
Expected Permeate Production								
Average production of one module	19,125	gpd	72,388	lpd	1,974	gpd	7,470	lpd
Modules Recommended								
Number of modules with no Overdesign	1.0		1.0		7.3		7.3	
Number of modules with Overdesign	1.3		1.3		10.9	*	10.9	*

NEW LOGIC RESEARCH
1295 67th Street Emeryville California 94608-1120 Phone: (510) 655-7305 Fax: (510)655-7307

3.1 Control System Summary – SDL Santo Domingo Landfill

Preliminary Electrical Info

Customer: SDL Santo Domingo Landfill
Location: Santo Domingo, Ecuador
Feed Material: Landfill Leachate

The final system controls design will be the results of detailed engineering and discussion between New Logic Research and the client. For the purpose of establishing a baseline, the following preliminary controls design is provided. It is not suggested that the following be a final system design. This information is only given for the purpose of describing the framework for controls design and how to start thinking about it.

3.1.1 Method of Control and Monitoring

The VSEP Filtration System will have a local control system. It will be possible to operate the system entirely from the local control panel. The system will consist of a Compact Logix PLC and a Versa View Industrial Computer with FT View SE HMI software. The computer has the capability of remote access via gotomypc.com. Remote access will allow monitoring and troubleshooting by New Logic engineers and will also allow any user to monitor the system data over the internet with a password. This is accomplished using Ethernet connections and a modem. It is recommended that New Logic be given access to real time data so that we can assist with ongoing service and support. This service is provided by New Logic at no cost to the customer and will help to improve overall system performance and reliability, especially during the early periods of operation when operators are still learning the functionality of VSEP.

The connections to the DCS can be accomplished by one the following:

1. VSEP PLC communicating directly to the DCS PLC, transferring requested sensor information.
2. VSEP PLC to a second HMI (duplicating FT View SE Screens).
3. VSEP PLC to DCS HMI (adding VSEP screens to the DCS screens).

Note: all of the above connections are accomplished by using an Ethernet connection.

3.1.2. Wiring Method

The central system will consist of Ethernet. The local VSEP control system consisting of PLC and HMI display panel will communicate over Ethernet network. VSEP system skids will have a control enclosure containing the Flex I/O modules. Ethernet will be used as a communication cable between the Flex I/O modules and the central PLC. The control enclosure will include a solenoid rack to control pneumatic valves, these racks will be factory wired to the I/O modules. Off skid sensors are typically hard wired to I/Os on the main enclosure.

The VSEP System Skid will require the following field interconnecting wiring for controls, **provided by New Logic**:

1. 24VDC or 220 VAC 5-15 amp power for devices
2. 4-20 mA signal wire for devices
3. Ethernet connections between HMI, Switch, and PLC
4. Ethernet Net to Flex I/O.

The VSEP System will require the following field interconnecting wiring for controls, **provided by others:**

5. 440VAC Power supply from VFDs in the Motor Control Center to the Motor Junction Boxes.
6. Power supply to the VFDs, or, if remote located in a Motor Control Center, to the Motor Junction Boxes
7. Ethernet to Flex I/O in CIP Enclosure
8. Ethernet communication cabling from the VSEP System to the DCS and/or Internet.
9. Ethernet to VFDs in MCC.
10. Managed Ethernet Switch
11. 4-20mA wiring to the level indicators located on the storage tanks.
12. 24 VDC wiring to transfer pump and off skid on/off valves
13. 220 VAC Control wiring power supply to the Main and CIP Enclosures
14. 220 VAC power wiring to metering pumps

3.1.3 440 VAC Power Summary

1). VSEP Feed Pump Skid:
The 440 VAC, 3 phase load is comprised of 3 Variable Frequency Drives that runs 2 feed pumps and 1 vibration drive motors.
Vibration VFD Model: AC Tech SMV Series ESV153E04TXD
There is 1 x 20 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.
Pump VFD Model: AC Tech SMV Series ESV233E04TXD
There are 2 x 25 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 39 Amps, 25HP, NEMA 4/12, English.

2). For the VSEP CIP Skid:
The 440 VAC, 3 phase load is comprised of 1 Variable Frequency Drive that will run 1 CIP pump.
Pump VFD Model: AC Tech SMV Series ESV153E04TXD
There is 1 x 20 Hp CIP Pump Drive VFD
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.

3). Stage-2 Spiral Feed Pump Skid:
The 440 VAC, 3 phase load is comprised of 2 Variable Frequency Drives that runs 2 feed pumps motors.
Vibration VFD Model: AC Tech SMV Series ESV153E04TXD
There are 2 x 20 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.

3.1.4 Full Load Power Rating:

440 VAC System Full Load Power Rating
Estimates are based on the maximum output rating for the Variable Frequency Drives, multiplied by 1.15

440 VAC 3 Phase. Total Maximum "Full Load Amps" FLA= 202.4 Amps

- Vibration Motor: 1 Circuit, 31.1 Amps Each
- VSEP Feed Pumps: 4 Circuits, 39.1 Amps Each
- CIP Pumps: 1 Circuit: 31.1 Amps Each.
- Spiral Feed Pumps: 2 Circuits, 31.1 Amps Each

From actual experience in the past, a more realistic estimate of the Full Load on the system would be 65% of the above estimate.

Actual predicted total RLA = 131.6 Amps

3.1.5 Variable Frequency Drive Control

The AC Tech drives will be connected by instrumentation cable to the Input/Output boards. The VSEP system Central PLC will send "Run", "Stop", and "Speed Control" signals. The VSEP system Central PLC will read "Run Confirm" and "Motor Load" signals.

3.1.6 Installation Conditions to be Resolved

1. VFDs will be provided by New Logic which will be NEMA 4 construction. They will be set up for remote installation wall or MCC.

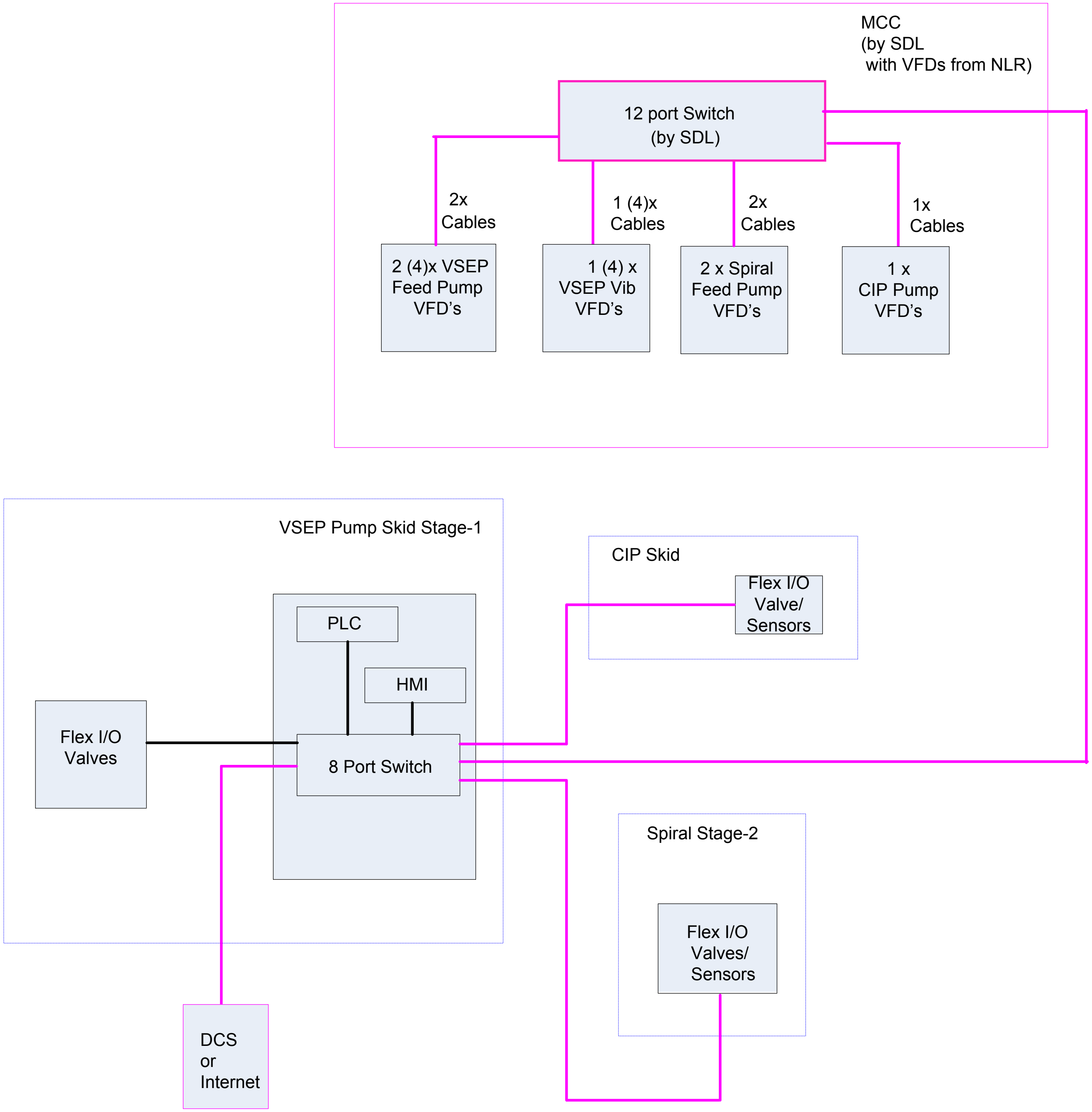
2. The location and type of any safety disconnect switch should be determined. (Provided by others)

3. Line Reactor/Filters provided by others.

4. Load Distribution Panels and Circuit Breakers provided by others.

5. Pre-Assembled Drive packages are not included. New Logic will provide AC Tech only.

6. Modern managed Ethernet switch provided by client, with the ability to set ports. Ports with cables going to all VFDs (which do not support auto negotiate) need to be set as “auto negotiate” off and also as “full duplex” on, and all other Ethernet ports back to all other Allen Bradley equipment can be set to “auto negotiate” on and they will auto set to full duplex on.



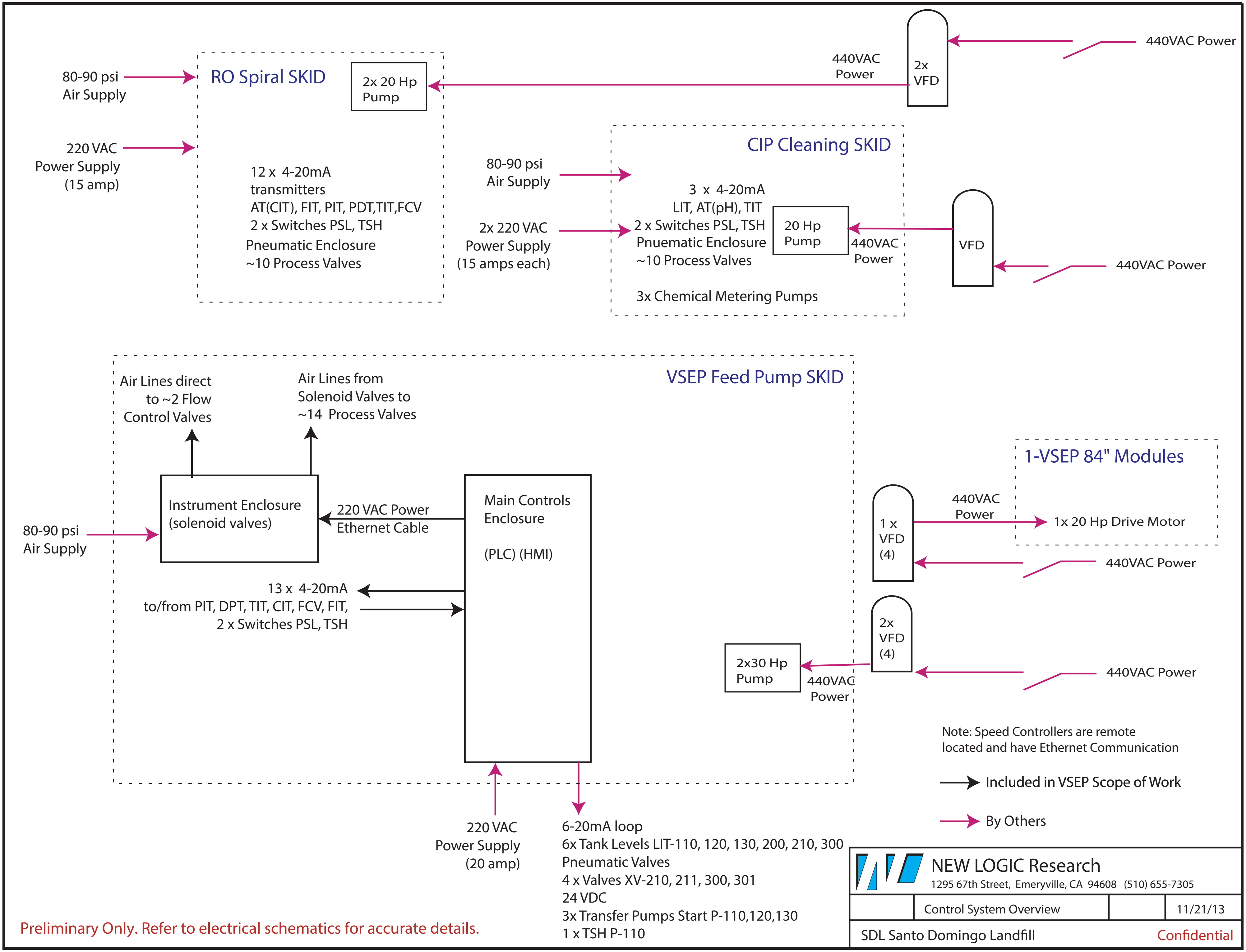
Note: NLR Recomends that customer supply modern Managed Switches with the ability to set ports. Ports with cables going to all VFDs (which do not support auto negotiate)need to be set as "auto negotiate" OFF and also as "full duplex" ON, and then all other Ethernet ports back to all other Allen Bradley equipment can be set to "auto negotiate" ON and they will auto set to full duplex ON.
For the Ethernet Cable we are specifying simple CAT5e UTP.
We have, so far, never needed shielded cable. We are more concerned about ground loops than we are about electrical noise.
If the customer feels that there is a compelling reason to use shielded cable, it is critical that shield grounds be connected properly.The cables must be grounded on 1 end only.
The cables must not be grounded at the VFDs. The cables should not be grounded at the processor.

ENET Supplied by customer

ENET Supplied by NLR

Preliminary Only.

New Logic Research Inc.	21 Nov 2013
SDL Santo Domingo	Ver A
Network Diagram	**G. Delly**


RO Spiral SKID
2x 20 Hp Pump
80-90 psi Air Supply
220 VAC Power Supply (15 amp)
12 x 4-20mA transmitters
AT(CIT), FIT, PIT, PDT,TIT,FCV
2 x Switches PSL, TSH
Pneumatic Enclosure
~10 Process Valves
440VAC Power
2x VFD
440VAC Power
CIP Cleaning SKID
80-90 psi Air Supply
2x 220 VAC Power Supply (15 amps each)
3 x 4-20mA
LIT, AT(pH), TIT
2 x Switches PSL, TSH
Pnuematic Enclosure
~10 Process Valves
20 Hp Pump
440VAC Power
VFD
440VAC Power
3x Chemical Metering Pumps
VSEP Feed Pump SKID
Air Lines direct to ~2 Flow Control Valves
Air Lines from Solenoid Valves to ~14 Process Valves
Instrument Enclosure (solenoid valves)
220 VAC Power
Ethernet Cable
Main Controls Enclosure
(PLC) (HMI)
80-90 psi Air Supply
13 x 4-20mA
to/from PIT, DPT, TIT, CIT, FCV, FIT,
2 x Switches PSL, TSH
1-VSEP 84" Modules
440VAC Power
1x 20 Hp Drive Motor
1 x VFD (4)
440VAC Power
2x VFD (4)
2x30 Hp Pump
440VAC Power
440VAC Power
Note: Speed Controllers are remote located and have Ethernet Communication
Included in VSEP Scope of Work
By Others
220 VAC Power Supply (20 amp)
6-20mA loop
6x Tank Levels LIT-110, 120, 130, 200, 210, 300
Pneumatic Valves
4 x Valves XV-210, 211, 300, 301
24 VDC
3x Transfer Pumps Start P-110,120,130
1 x TSH P-110
Preliminary Only. Refer to electrical schematics for accurate details.
NEW LOGIC Research
1295 67th Street, Emeryville, CA 94608 (510) 655-7305
Control System Overview
11/21/13
SDL Santo Domingo Landfill
Confidential

SMV Series Ratings & Dimensions

Vibration Drive VFD	ESV153N04TXD	x1
Feed Pump Drive VFDs	ESV233E04TXD	x2
CIP Pump Drive VFDs	ESV153N04TXD	x1
Spiral Pump Drives VFDs	ESV153N04TXD	x2

HP	kW	Voltage Input	Phase	3 Phase Output Amps	3 Phase Mains Amps	CB/ FUSE SIZING	NEMA 4 Model Number	Dims
20	15.00	480/400	3Ø	27/31	31/35	40	ESV153E04TXD	9.42x14.38x9.45"
25	18.75	480/400	3Ø	34/39	38/44	50	ESV233E04TXD	9.42x14.38x9.45"

400...480VAC Models

400 ... 480V Three Phase (3/PE) (400V: 340...440V), (480V: 340...528V); 48...62Hz											
Type	Power		Mains Current		Output Current				Heat Loss (Watts)		
	Hp	kW	400V A	480V A	Cont (I_n) A		Max I %		N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
					400V	480V	400V	480V			
ESV371--4T--	0.5	0.37	1.7	1.5	1.3	1.1	175	200	23	21	25
ESV751--4T--	1	0.75	2.9	2.5	2.4	2.1	175	200	37	33	37
ESV112--4T--	1.5	1.1	4.2	3.6	3.5	3.0	175	200	48	42	46
ESV152--4T--	2	1.5	4.7	4.1	4.0	3.5	175	200	57	50	54
ESV222--4T--	3	2.2	6.1	5.4	5.5	4.8	175	200	87	78	82
ESV302--4T--	4	3.0	8.3	7.0	7.6	6.3	175	200			95
ESV402--4T--	5	4.0	10.6	9.3	9.4	8.2	175	200	128	103	111
ESV552--4T--	7.5	5.5	14.2	12.4	12.6	11.0	175	200	178	157	165
ESV752--4T--	10	7.5	18.1	15.8	16.1	14.0	175	200	208	190	198
ESV113--4T--	15	11	27	24	24	21	155	180	418	388	398
ESV153--4T--	20	15	35	31	31	27	155	180	493	449	459
ESV183--4T--	25	18.5	44	38	39	34	155	180	645	589	600
ESV223--4T--	30	22	52	45	46	40	155	180	709	637	647

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0

For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1

Type		Recommendations				
		Fuse	Miniature circuit breaker(1)	Fuse (2) or Breaker(3) (N. America)	Input Power Wiring (L1, L2, L3, PE)	
					[mm²]	[AWG]
400V or 480V 3~(3/PE)	ESV371N04TXB ...ESV222N04TXB ESV371N04T_* ...ESV222N04T_* ESV371N04TF* ...ESV222N04TF*	M10 A	C10 A	10 A	1.5	14
	ESV302N04T_*	M16 A	C16 A	15 A	2.5	14
	ESV402N04TXB, ESV402N04T_*	M16 A	C16 A	20 A	2.5	14
	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14
	ESV752N04TXB, ESV752N04T_~	M25 A	C25 A	25 A	4.0	10
400V or 480V 3~(3/PE)	ESV113N04TXB, ESV113N04T_~	M40 A	C40 A	40 A	4	8
	ESV153N04TXB, ESV153N04T_~	M50 A	C50 A	50 A	10	8
	ESV183N04TXB, ESV183N04T_~	M63 A	C63A	70 A	10	6
	ESV223N04TXB, ESV223N04T_~	M80 A	C80 A	80 A	16	6

2.2 SMV Type Number Designation

The table herein describes the Type numbering designation for the SMVector Inverter models.

ESV	152	N0	2	T	X	B

Electrical Products in the SMVector Series (ESV)

Power Rating in kW: (152)

251 = 0.25kW (0.33HP)	113 = 11.0kW (15HP)
371 = 0.37kW (0.5HP)	153 = 15.0kW (20HP)
751 = 0.75kW (1HP)	183 = 18.5kW (25HP)
112 = 1.1kW (1.5HP)	223 = 22.0kW (30HP)
152 = 1.5kW (2HP)	
222 = 2.2kW (3HP)	
302 = 3.0kW (4HP)	
402 = 4.0kW (5HP)	
552 = 5.5kW (7.5HP)	
752 = 7.5kW (10HP)	

Installed I/O & Communication Module(s): (N0)

C_ = CANopen (Available all models)	The "_" blank can be:
D_ = DeviceNet (Available all models)	0 = Standard Keypad
E_ = Ethernet/IP, ModBus TCP/IP (Avail all models)	N = No Keypad (NEMA 4X / IP65 only)
R_ = RS-485 / ModBus /Lecom (Avail all models)	
P_ = ProfiBus-DP (Available all models)	
N_ = No Communications installed (Non-IP20)	

Input Voltage: (2)

- 1 = 120 VAC (doubler output) or 240 VAC
- 2 = 240 VAC
- 4 = 400/480 VAC
- 6 = 600 VAC

Input Phase: (T)

- S = Single Phase Input only
- Y = Single or Three Phase Input
- T = Three Phase Input only

Input Line Filter (X)

- F = Integral EMC Filter
- L = Integral EMC Filter and Integrated Line Disconnect (NEMA 4X/IP65 Models only)
- M = Integrated Line Disconnect (NEMA 4X/IP65 Models only)
- X = No EMC Filter/No Line Disconnect

Enclosure: (B)

- B = NEMA 1/IP31; Indoor only
- C = NEMA 4X/IP65; Indoor only; Convection cooled
- D = NEMA 4X/IP65; Indoor only; Fan cooled
- E = NEMA 4X/IP65; Indoor/Outdoor; Convection cooled
- F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled

NOTE

Prior to installation make sure the enclosure is suitable for the end-use environment

Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminates, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).

SMVector NEMA4X | Washdown Duty Inverter

Lenze AC Tech

RoHS COMPLIANT

World Class Control

Modes of Operation
- Open Loop Flux Vector, Speed or Torque Control
- V/Hz (Constant or Variable)
- Base Frequency Adjustable to Motor Specs
- Enhanced V/Hz with Auto-tuning

Acceleration/Deceleration Profiles
- Two Independent Accel Ramps
- Two Independent Decel Ramps
- Linear, S-Type
- Auxiliary Ramp(or Coast)-to-Stop

Fixed Accel Boost for Improved Starting

500 Hz Output Frequency

High Carrier PWM Sine-Coded Frequency
- 4, 6, 8, 10 or 12 kHz

Universal Logic Assertion (Selectable)
- Positive or Negative Logic Input
- Digital Reference Available

Braking Functions
- DC Injection Braking
- Optional Dynamic Braking

Speed Commands
- Keypad, Potentiometer
- Jog, 8 Preset Speeds
- Floating Point Control
- Voltage: Scalable 0 –10 VDC
- Current: Scalable 4 – 20 mA

Process Control
- PID Modes: Direct and Reverse Acting
- PID Sleep Mode
- Analog Output (Speed, Load, Torque, kW)
- Network Speed (Baud Rate)
- Terminal and Keypad Status
- Elapsed Run or Power On Time (Hours)

Status Outputs
- Programmable Form “A” Relay Output
- Programmable Open Collector Output
- Scalable 0-10 VDC / 2-10 VDC Analog Output

Run Screen Display
- Multiplier: 4-20mA w/500 Ohm Total Impedance

Environment

Ambient Temperature
- -10 to 55°C @ 6 kHz
- Derate 2.5% per °C Above 40°C

Comprehensive Diagnostic Tools

Real Time Monitoring
- 8 Register Fault History
- Software Version
- Drive Network ID
- DC Bus Voltage (V)
- Motor Voltage (V)
- Output Current (%)
- Motor Current (A)
- Motor Torque (%)
- Power (kW)
- Energy Consumption (kWh)
- Heatsink Temperature (°C)
- 0 – 10 VDC Input (User Defined)
- 4 – 20 mA Input (User Defined)
- PID Feedback (User Defined)

Vigilant System Protection

Voltage Monitoring
- Low and High DC Bus V Protection
- Low Line V Compensation
- Parameters can be reset for 50 or 60 Hz Motors

Current Monitoring
- Motor Overload Protection
- Current Limiting Safeguard
- Ground Fault
- Short Circuit Protection

Three ReStarts
- Two Flying and One Auto
- Password Protected

Loss of Follower Management
- Protective Fault
- Go to Preset Speed or Preset Setpoint
- Initiate System Notification

Over Temperature Protection

International Voltages

- +10/-15% Tolerance
- 120/240V, 1Ø
- 200/240V, 1 or 3Ø
- 200/240V, 3Ø
- 400/480V, 3Ø
- 480/600V, 3Ø

Global Standards

UL	GOST
cUL	C-Tick

CE Low Voltage (EN61800-5-1)
CE EMC (EN61800-3) with optional EMC filter

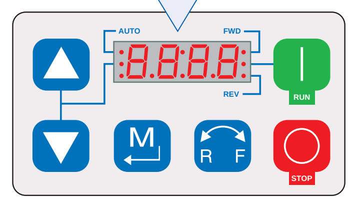
Keypad & Display

Simple Six Button Programming
- Start • Scroll Up
- Stop • Scroll Down
- Forward/Reverse • Enter/Mode

Informative LED Display
Vivid Illumination
Easily Read from a Distance

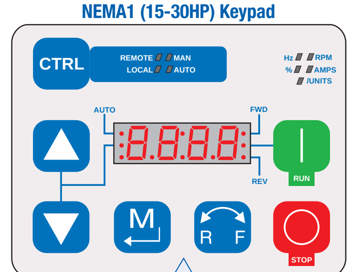
Five Status LEDs
- Run
- Automatic Speed mode
- Manual Speed Mode
- Forward Rotation
- Reverse Rotation

Status Display
- Motor Status
- Fault Management
- Operational Information



NEMA1 (Up to 10HP) Keypad

NEMA1 (15-30HP) Keypad



Additional CTRL Button
Switch between control modes
- Local-Manual • Local Auto
- Remote-Manual • Remote Auto

Additional LED Indicators
Define the units being displayed
- Hz • RPM • %
- Amps • /Units

Control Terminals

Digital Inputs
- Dedicated Start/Stop
- (3) Programmable

Digital Outputs
- Form “A” Relay
- Open Collector

Analog Inputs
- 0 - 10 VDC
- 4 - 20 mA

Analog Outputs
- 0 - 10 VDC
- 2 - 10 VDC

Power Supplies
- 10 VDC Potentiometer Ref
- 12 VDC, 20 mA DI Ref or 0VDC Com
- 12 VDC, 50 mA Supply

Common

Additional Control Terminals (15 HP & up)
1 Programmable Digital Input
1 Common
RS-485 Modbus Communications
- TXA
- TXB

Lenze AC Tech SMVector NEMA4X | Washdown Duty Inverter

Ratings

120/240V* - 1Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C] / Outdoor [E]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	2.4	ESV371N01SX[C] or [E]	R1	ESV371N01SMC	AA1
1	0.75	4.2	ESV751N01SX[C] or [E]	R1	ESV751N01SMC	AA1
1.5	1.1	6.0	ESV112N01SX[C] or [E]	R2	ESV112N01SMC	AA2

*Output voltage will be twice line voltage when connected to a 120V source. Output voltage will not exceed line voltage when connected to a 240V source.

200/240V - 1 or 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C] / Outdoor [E]*		NEMA4X w/Disconnect Indoor**	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	2.4	ESV371N02YX[C] or [E]	R1	ESV371N02YMC	AA1
1	0.75	4.2	ESV751N02YX[C] or [E]	R1	ESV751N02YMC	AA1
1.5	1.1	6.0	ESV112N02YX[C] or [E]	R2	ESV112N02YMC	AA2
2	1.5	7.0	ESV152N02YX[C] or [E]	R2	ESV152N02YMC	AA2
3	2.2	9.6	ESV222N02YX[C] or [E]	S1	ESV222N02YMC	AD1

*Filter versions are also available in 1-phase: Replace the "YX" in the Model Part Number with an "SF".
**Filter versions are also available in 1-phase: Replace the "YM" in the Model Part Number with an "SL".
***Model ESV251N02SXB is single-phase input only.

200/240V - 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
5	4	16.5	ESV402N02TX[C] or [E]	V1	ESV402N02TMC	AC1
7.5	5.5	23	ESV552N02TX[D] or [F]	T1	ESV552N02TMD	AB1
10	7.5	29	ESV752N02TX[D] or [F]	T1	ESV752N02TMD	AB1
15	11	42	ESV113N02TX[D] or [F]	W1	ESV113N02TMD	AF1
20	15	54	ESV153N02TX[D] or [F]	W1	ESV153N02TMD	AF1

400/480V - 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]*		NEMA4X w/Disconnect Indoor**	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	1.3/1.1	ESV371N04TX[C] or [E]	R1	ESV371N04TMC	AA1
1	0.75	2.4/2.1	ESV751N04TX[C] or [E]	R1	ESV751N04TMC	AA1
1.5	1.1	3.5/3.0	ESV112N04TX[C] or [E]	R2	ESV112N04TMC	AA2
2	1.5	4.0/3.5	ESV152N04TX[C] or [E]	R2	ESV152N04TMC	AA2
3	2.2	5.5/4.8	ESV222N04TX[C] or [E]	R2	ESV222N04TMC	AA2
4	3.0	7.6/6.3	ESV302N04TX[C] or [E]	R2	ESV302N04TMC	AA2
5	4	9.4/8.2	ESV402N04TX[C] or [E]	V1	ESV402N04TMC	AC1
7.5	5.5	12.6/11	ESV552N04TX[C] or [E]	V1	ESV552N04TMC	AC1
10	7.5	16.1/14	ESV752N04TX[D] or [F]	T1	ESV752N04TMD	AB1
15	11	24/21	ESV113N04TX[D] or [F]	W1	ESV113N04TMD	AE1
20	15	31/27	ESV153N04TX[D] or [F]	W1	ESV153N04TMD	AE1
25	18.5	39/34	ESV183N04TX[D] or [F]	W1	ESV183N04TMD	AF1
30	22	46/40	ESV223N04TX[D] or [F]	X1	ESV223N04TMD	AF1

*Filter versions are also available in 1-phase: Replace the "X" in the Model Part Number with an "F".
**Filter versions are also available in 1-phase: Replace the "M" in the Model Part Number with an "L".

600V - 3Ø Input (3Ø Output)

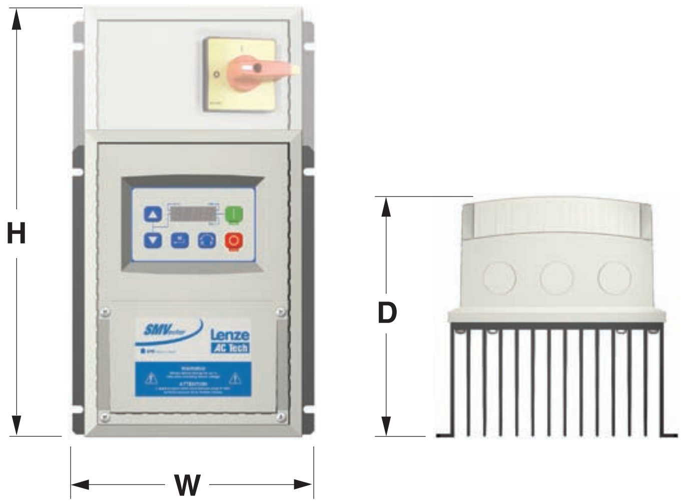
Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
1	0.75	1.7	ESV751N06TX[C] or [E]	R1	ESV751N06TMC	AA1
2	1.5	2.7	ESV152N06TX[C] or [E]	R2	ESV152N06TMC	AA2
3	2.2	3.9	ESV222N06TX[C] or [E]	R2	ESV222N06TMC	AA2
5	4	6.1	ESV402N06TX[C] or [E]	V1	ESV402N06TMC	AC1
7.5	5.5	9	ESV552N06TX[C] or [E]	V1	ESV552N06TMC	AC1
10	7.5	11	ESV752N06TX[D] or [F]	T1	ESV752N06TMD	AB1
15	11	17	ESV113N06TX[D] or [F]	W1	ESV113N06TMD	AE1
20	15	22	ESV153N06TX[D] or [F]	W1	ESV153N06TMD	AE1
25	18.5	27	ESV183N06TX[D] or [F]	W1	ESV183N06TMD	AF1
30	22	32	ESV223N06TX[D] or [F]	X1	ESV223N06TMD	AF1

Dimensions

Dimensions

	H		W		D	
	in.	*mm*	*in.*	*mm*	*in.*	*mm*
R1	8.00	203	6.30	160	4.50	114
R2	8.00	203	6.30	160	6.30	160
S1	8.00	203	7.10	181	6.80	172
T1	10.00	254	8.10	204	8.00	203
V1	10.00	254	9.00	228	8.00	203
W1	14.40	366	9.40	240	9.50	241
X1	18.50	470	9.40	240	9.50	241
AA1 (4)	11.00	279	6.30	160	5.40	136
AA2 (4)	11.00	279	6.30	160	7.20	182
AB1 (4)	13.00	330	8.10	204	8.90	225
AC1 (4)	13.00	330	9.00	228	9.00	226
AD1 (4)	11.00	279	7.10	181	7.70	194
AE1 (4)	14.40	366	9.40	240	10.30	261
AF1 (4)	18.50	470	9.40	240	11.20	285

(4) The "D" (depth) dimension includes the disconnect switch.



Options

Communication Modules (Only one Communication module can be installed at a time.)	
Item Number	Item Description
ESVZAC0	CANopen Communications Interface Module
ESVZAR0	RS-485/Modbus Communications Interface Module
ESVZAP0	PROFIBUS DP Communications Interface Module
ESVZAD0	DeviceNet Communications Interface Module
ESVZAE0	EtherNet/IP Communications Interface Module
Keypad	
ESVZXK1	Remote Keypad w/ drive interface module & cable up to 10HP (7.5kW)
ESVZXH0	Remote Keypad w/ cable 15HP (11kW) and up
Additional I/O (cannot be used with Communication modules or Remote keypad ESVZXK1)	
ESVZAL0	Additional Form C Relay Output Module
ESVZAL1	Additional I/O Module w/ 1 Form C Relay Output and 2 Digital Inputs
Potentiometer	
ESVZXM1	NEMA 4X terminal cover with integral speed potentiometer (W = 6.3 or 7.1 in)
ESVZXM2	NEMA 4X terminal cover with integral speed potentiometer (W = 9.0 or 8.1 in)
ESVZXM3	NEMA 4X terminal cover with integral speed potentiometer (W = 9.4 in)

Dynamic Braking Modules with Built-in Resistors				
			Motor Voltage	
HP	(kW)	208 to 230 V Part Number	400 to 480 V Part Number	480 to 600 V Part Number
0.33 - 0.5	(0.25-0.37)	EZXDB3712A1	EZXDB3714A1	N/A
1 - 1.5	(0.75 - 1.1)	EZXDB1122A1	EZXDB1124A1	EZXDB1126A1
2 - 3	(1.5 - 2.2)	EZXDB2222A1	EZXDB2224A1	EZXDB2226A1
5	(4)	EZXDB4022A1	EZXDB4024A1	EZXDB4026A1
7.5	(5.5)	EZXDB5522A1	EZXDB5524A1	EZXDB5526A1
10	(7.5)	EZXDB7522A1	EZXDB7524A1	EZXDB7526A1
Dynamic Braking Modules without Built-in Resistors				
15 - 20	(11 - 15)	EZXDC1532A1	N/A	N/A
15 - 30	(11 - 22)	N/A	EZXDC2234A1	EZXDC2236A1
Open Dynamic Braking Resistors with mounting brackets				
15 - 20	(11 - 15)	841-009	841-009	841-010
25 - 30	(18.5 - 22)	N/A	841-011	841-012

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

CIRCUIT BREAKERS

IN MAIN ENCLOSURE:
CB0: Main Enclosure
CB1: PLC
CB2: Computer (HMI)
CB3: DC Power
CB4: PLC Digital I/O
CB5: Pump Seal Switch (TSH101, TSH103)
CB6: Power for Instrumentation Enclosure

IN CIP ENCLOSURE:
CB30: CIP Enclosure
CB31: Metering Pump Relays
CB32: Flex I/O 24 VDC Power Supply
CB33: Pump Seal Switch (TSH190)
CB34: Chemical Metering Pump Power

IN SPIRAL ENCLOSURE:
CB50: Spiral Enclosure
CB51: Digital I/O
CB52: Flex I/O 24VDC Power Supply
CB53: DC Power
CB54: Pump Seal Switch (TSH201)

FUSES

IN MAIN ENCLOSURE:
F1: 2A to VSEP #1 (PIT110, PIT111, PIT112)
F2: 2A to VSEP #1 (FIT111, FIT112)
F3: 2A to VSEP #2 (PIT120, PIT121, PIT122)
F4: 2A to VSEP #2 (FIT121, FIT122)
F5: 2A to VSEP #3 (PIT130, PIT131, PIT132)
F6: 2A to VSEP #3 (FIT131, FIT132)
F7: 2A to VSEP #4 (PIT140, PIT141, PIT142)
F8: 2A to VSEP #4 (FIT141, FIT142)
F9: 2A to Feed System (PIT100, TIT100, PDT100)
F10: 2A to VSEP System (AT100, AT101)
F11: 2A to Feed System (PDT101, AI1, AI2)
F12: 2A to External (LIT110, LIT120, LIT130)
F13: 2A to External (LIT200, LIT210, LIT300)
F14: 2A to Ethernet Switch, Air Supply Pressure Switch (PSL100)
F15: 2A to Pump Switch (TSH110)

IN SPIRAL ENCLOSURE:
F51: 2A to Spiral (PIT200, PIT201, PIT202)
F52: 2A to Spiral (PDT200, PDT201, TIT200)
F53: 2A to Spiral (FIT200, FIT201)
F54: 2A to Spiral (AT200, AT201)
F55: 2A to Flex I/O
F56: 2A to Air Supply Pressure Switch (PSL200)

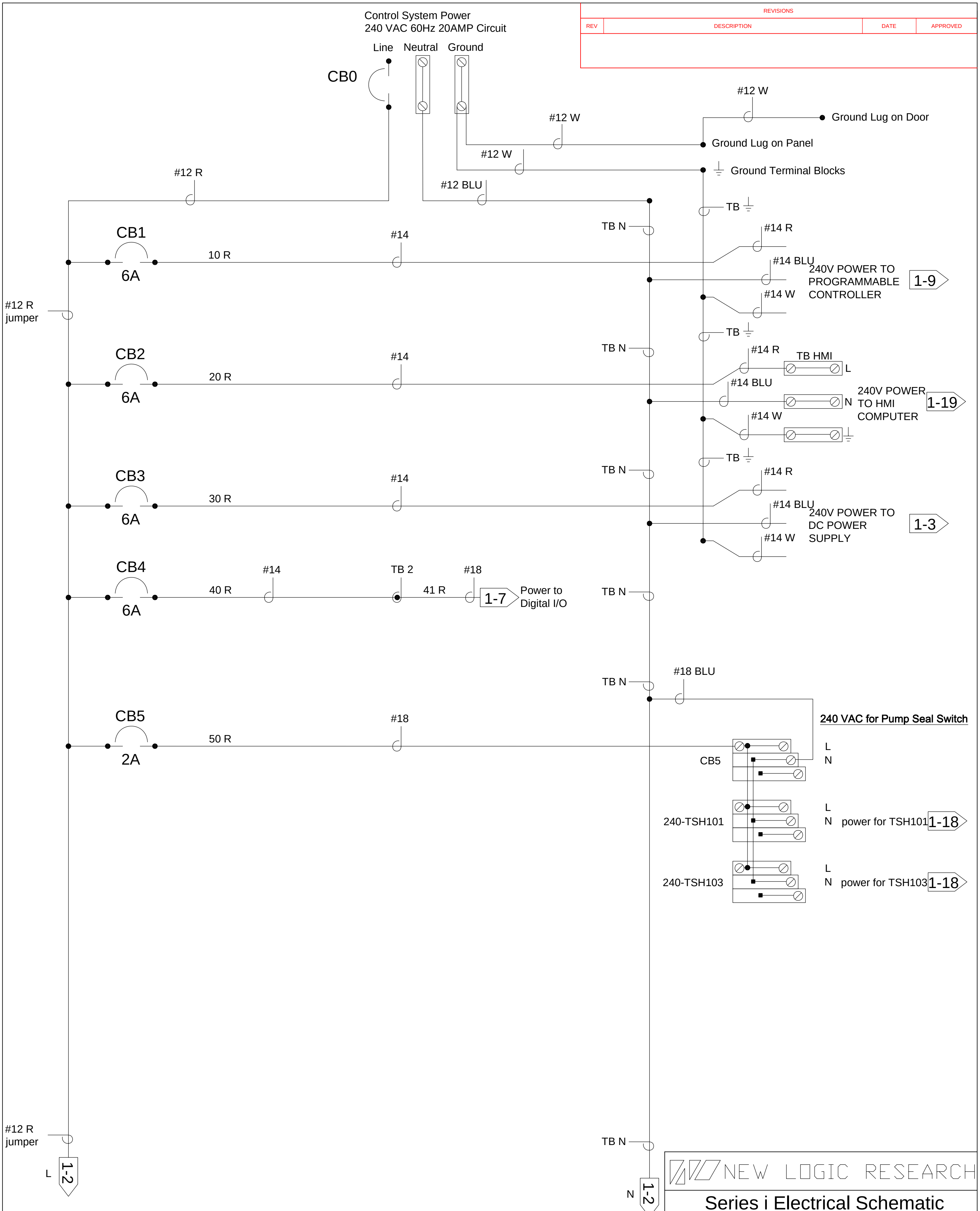
NEW LOGIC RESEARCH

Series i Electrical Schematic
Enclosure Label

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-0	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 0 of 49



REVISIONS

REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

Series i Electrical Schematic
Single Phase - 1

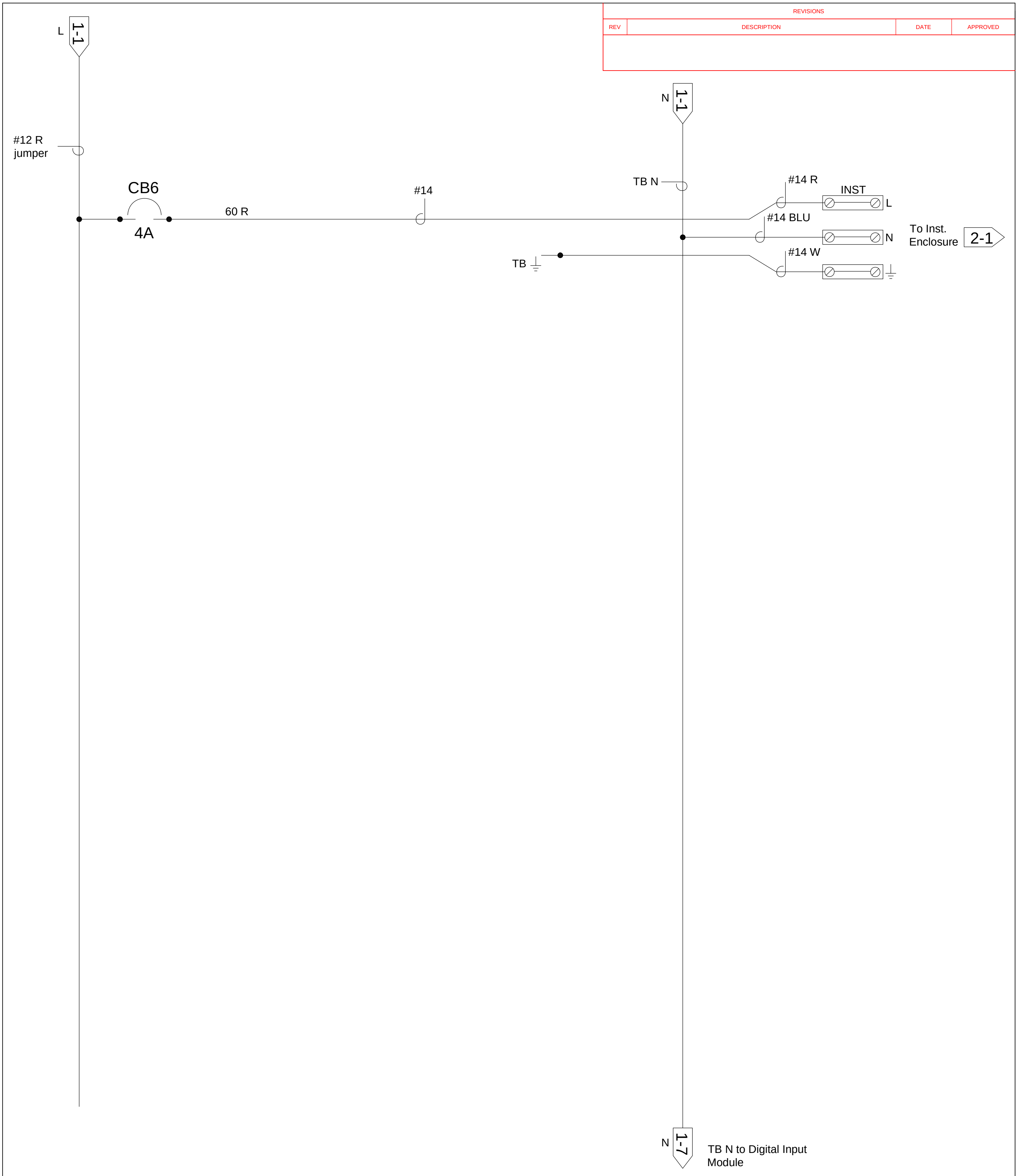
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

SHEET 1 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



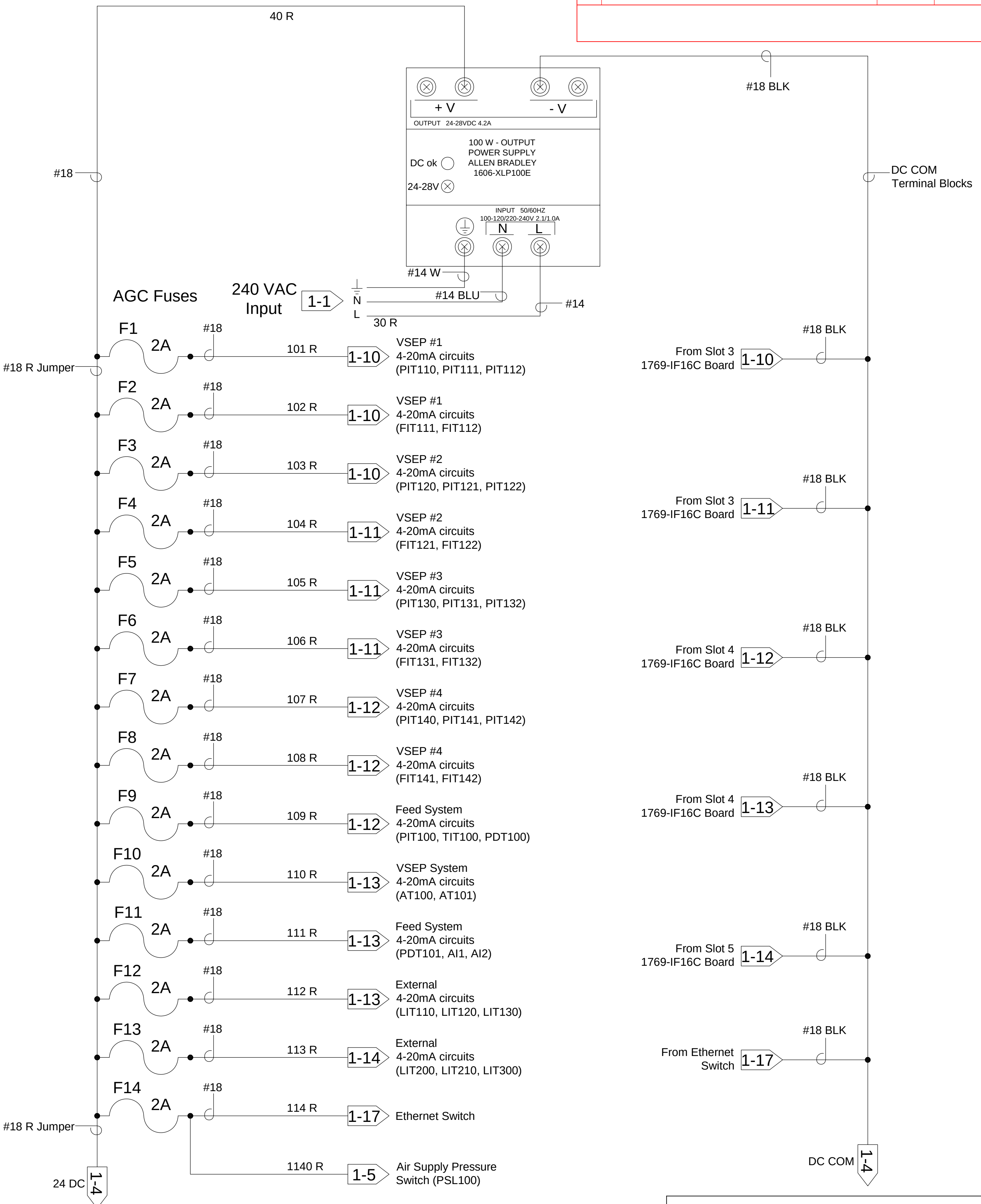
NEW LOGIC RESEARCH

Series i Electrical Schematic
Single Phase - 2

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-2	iEL 4-440-60-ac SDL	
PROJECT: Santo Domingo Landfill-MAIN		SHEET	2 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic

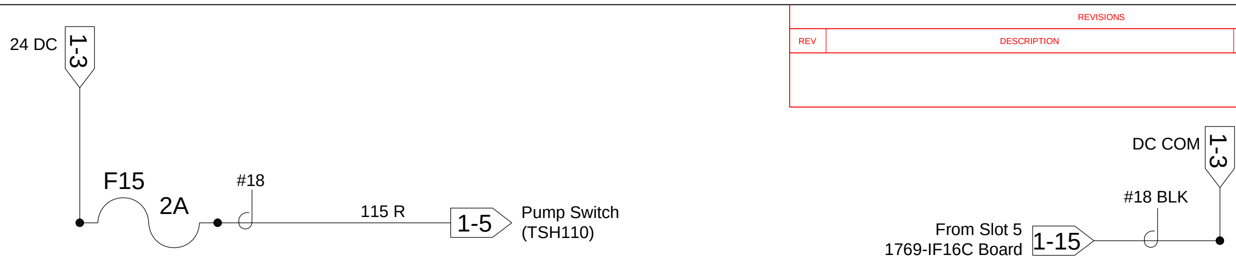
DC - 1

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

SHEET 3 of 49



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

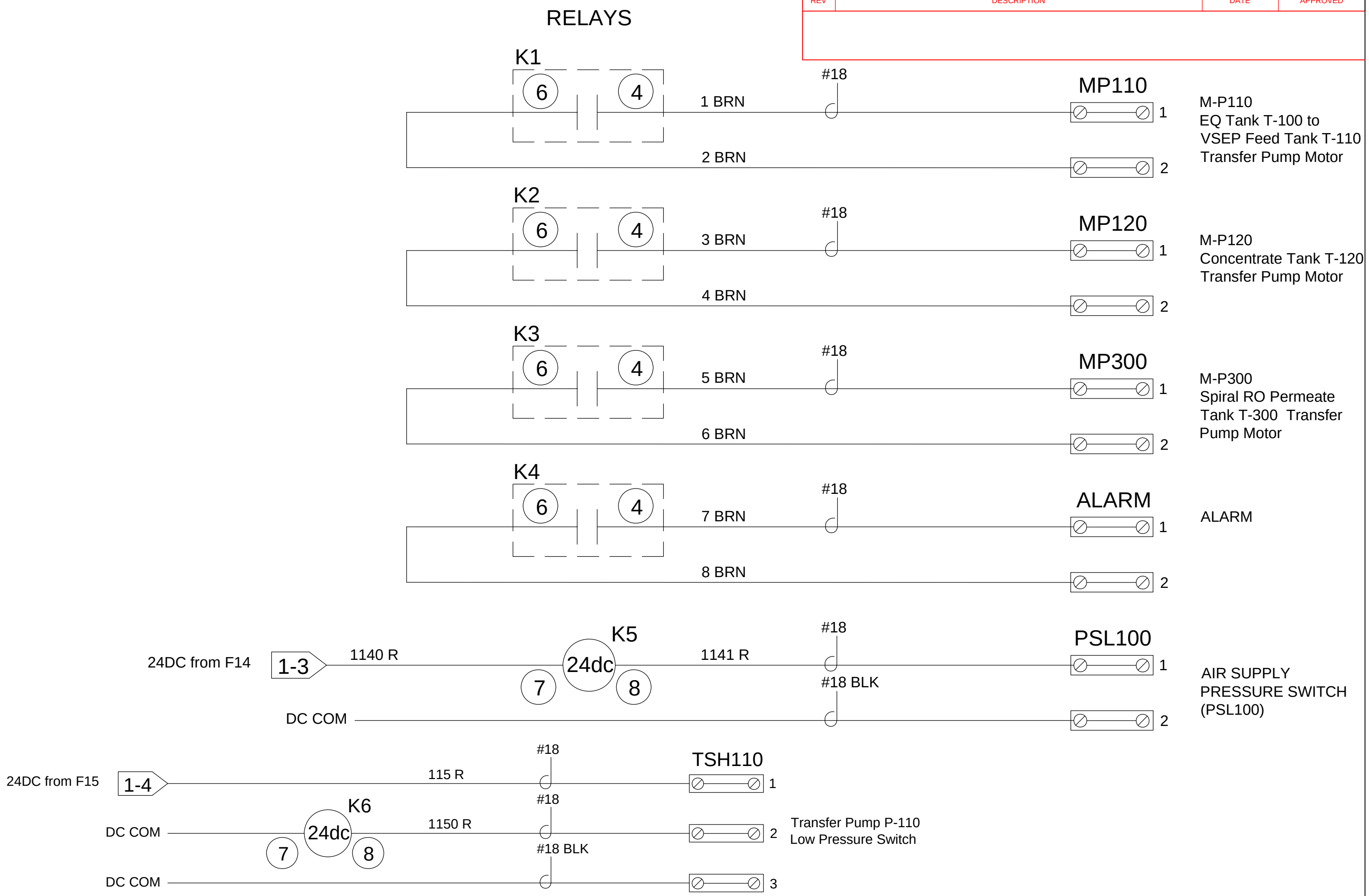
Series i Electrical Schematic
DC - 2

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 4 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



SWITCH TRANSMITTER CONNECTION

Connect BRN to "1" terminal
Connect BLK to "2" terminal
Connect BLU to "3" terminal

NEW LOGIC RESEARCH

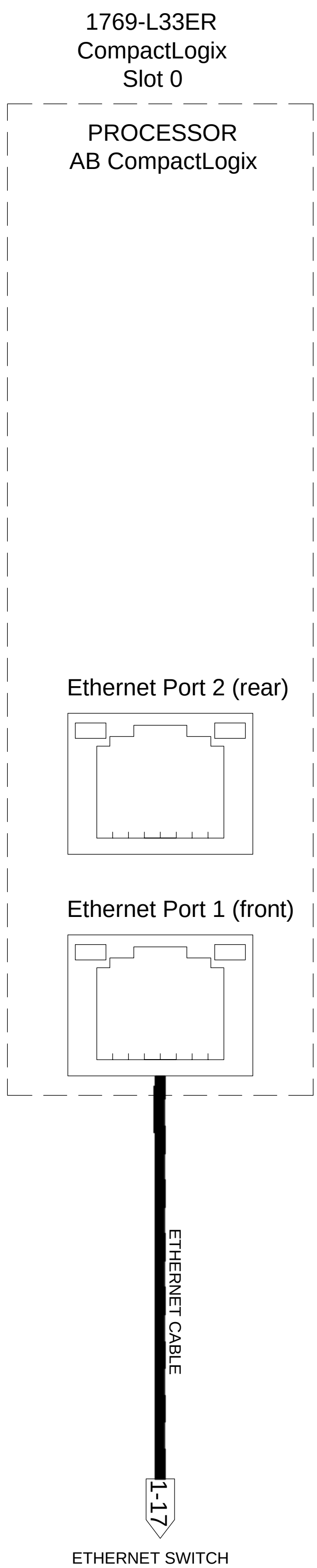
Series i Electrical Schematic
Relay

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-5	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 5 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



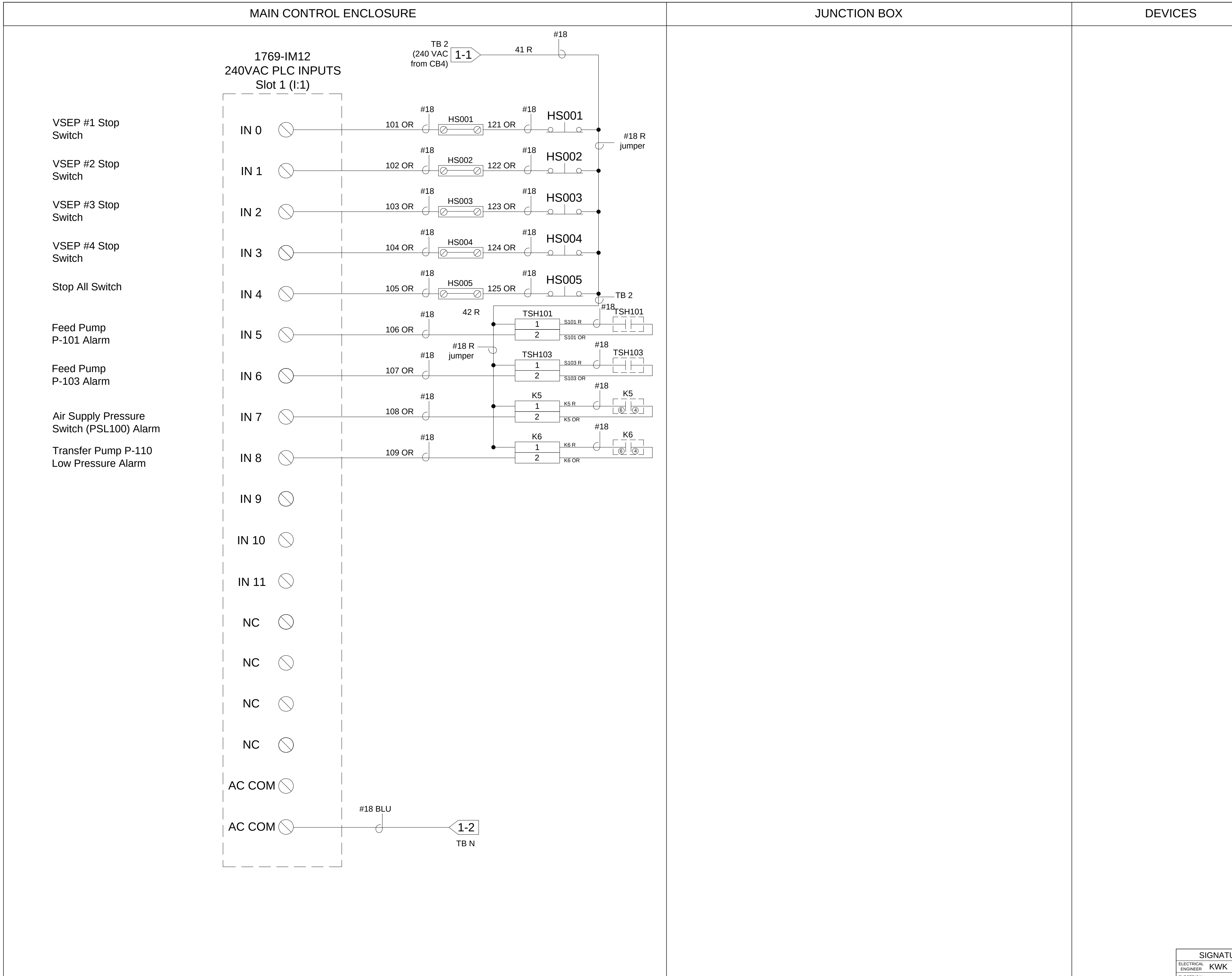
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-6	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 6 of 49



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

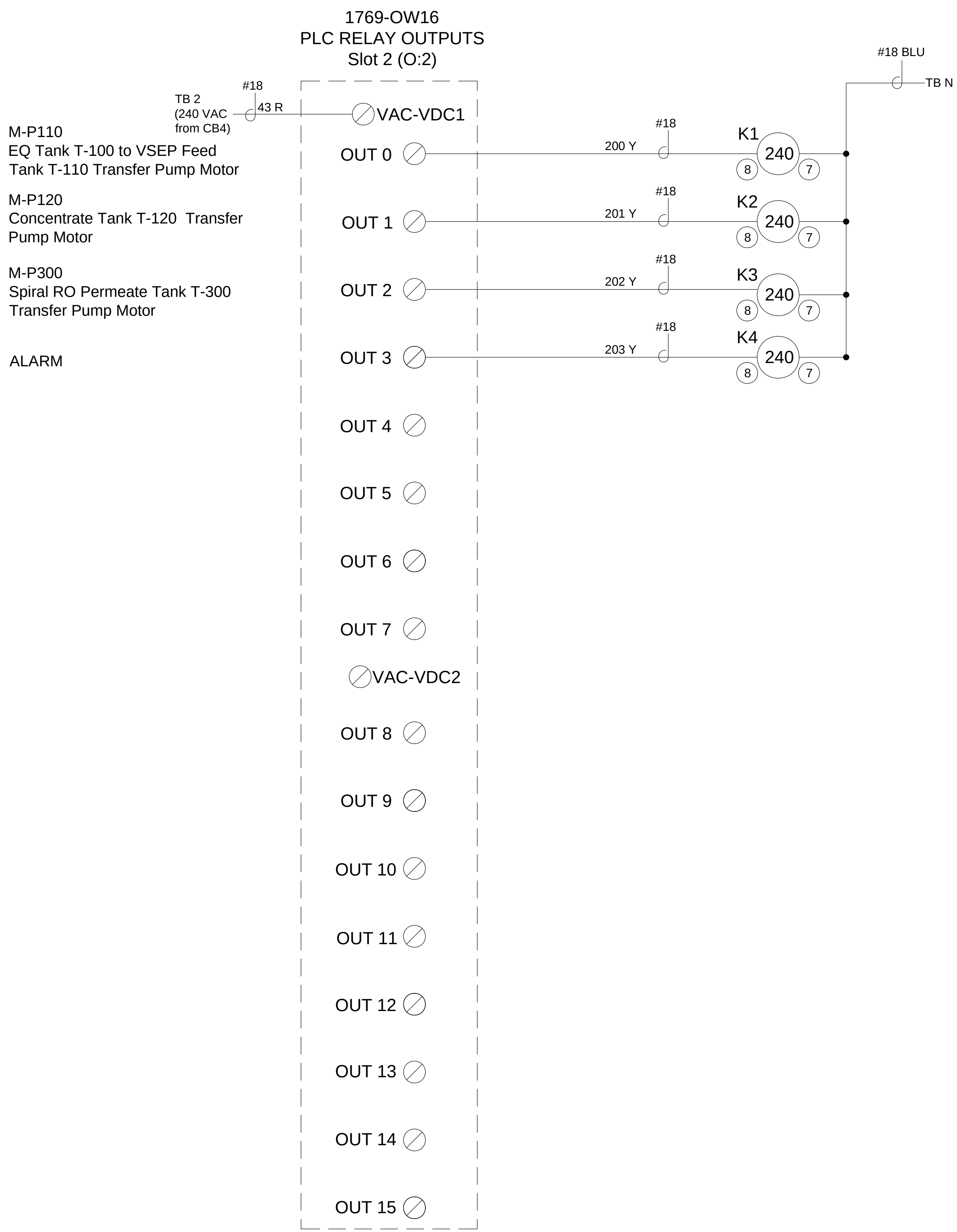
Series i Electrical Schematic
PLC_1DI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE: A | DWG NO.: 1-7 | FILE: iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 7 of 49

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES



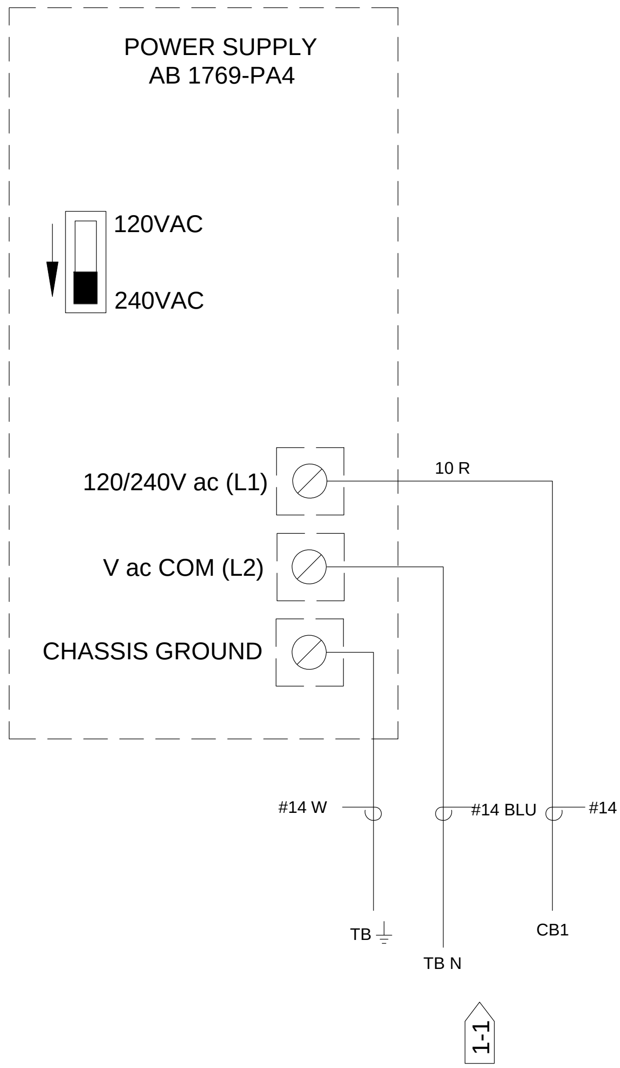
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_2RO

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-8	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET 8 of 49	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



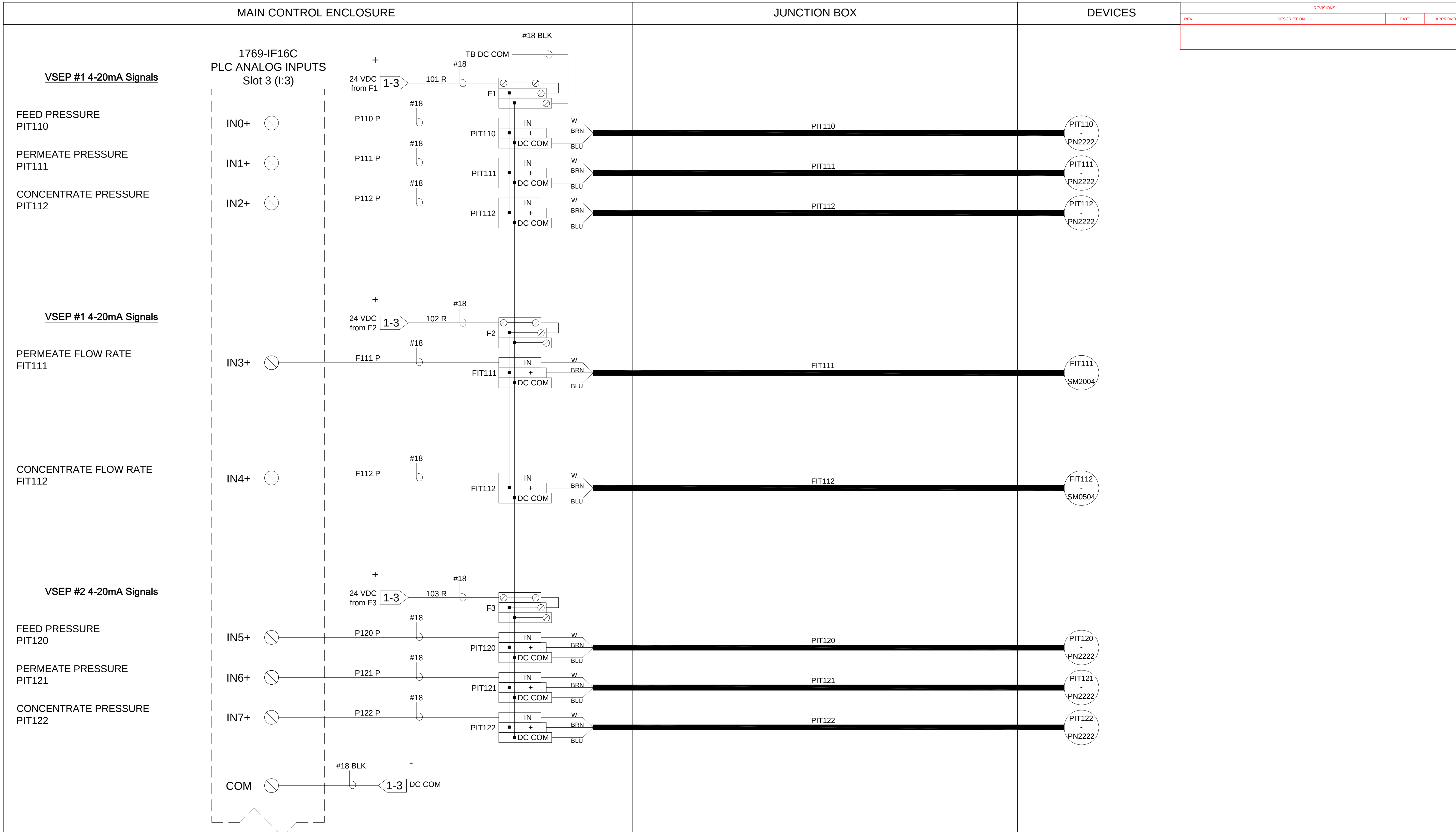
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_Power-Supply

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-9	iEL 4-440-60-ac SDL	

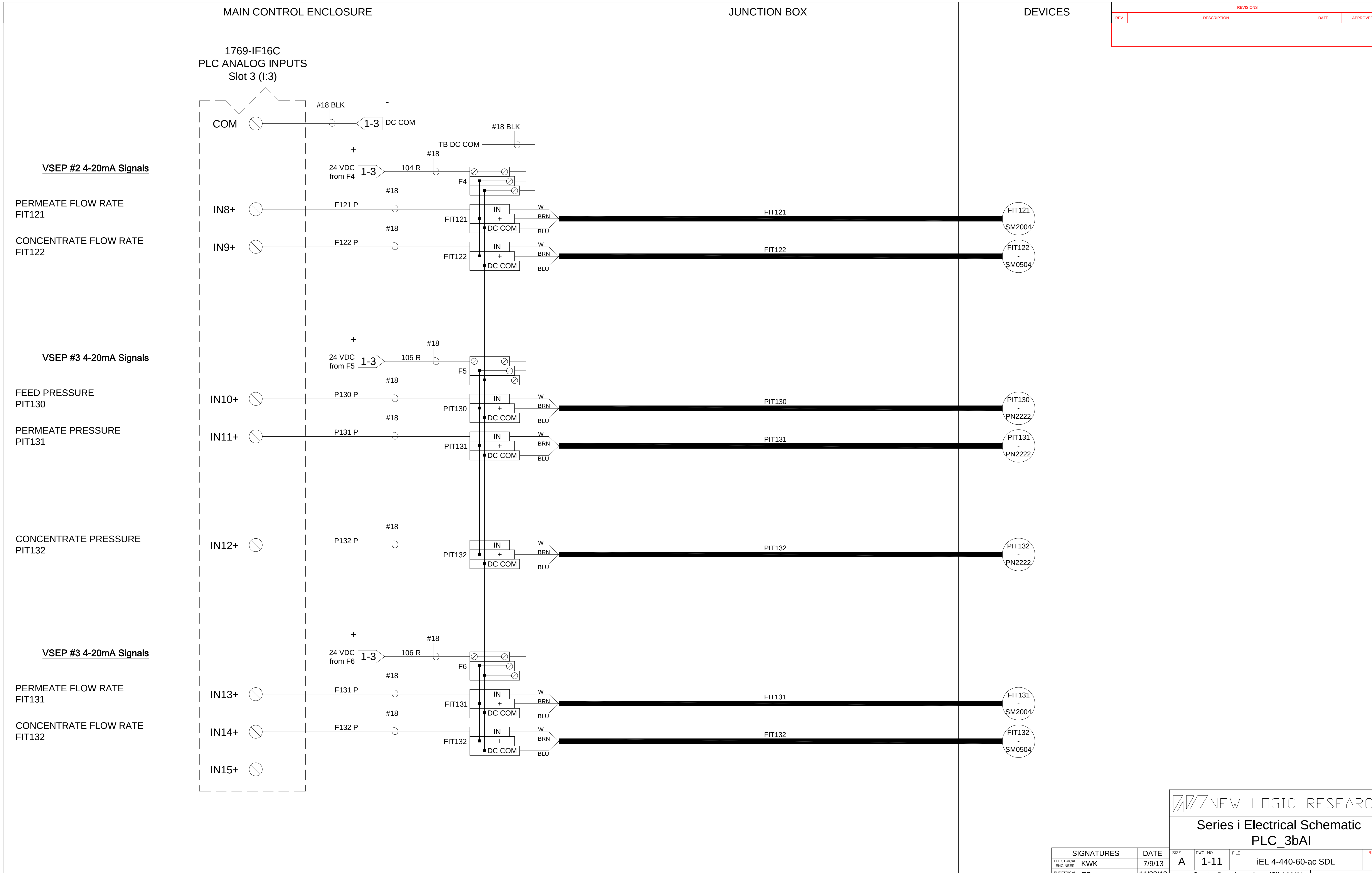
PROJECT: Santo Domingo Landfill-MAIN SHEET 9 of 49

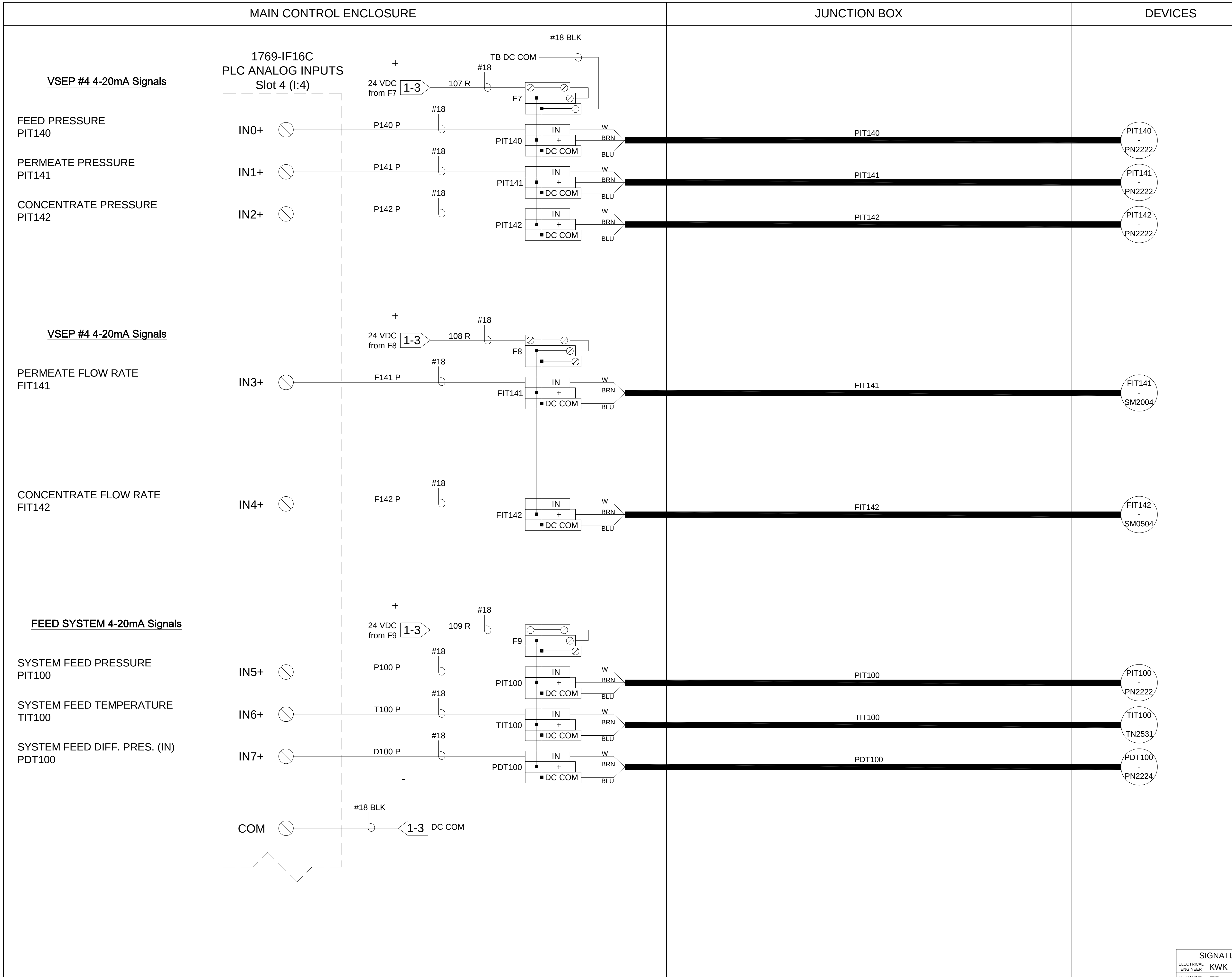


NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_3aAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-10	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET 10 of 49	


MAIN CONTROL ENCLOSURE
JUNCTION BOX
DEVICES
REVISIONS
REV
DESCRIPTION
DATE
APPROVED
1769-IF16C
PLC ANALOG INPUTS
Slot 3 (I:3)
COM
#18 BLK
-
1-3
DC COM
#18 BLK
TB DC COM
+
#18
VSEP #2 4-20mA Signals
24 VDC
from F4
1-3
104 R
F4
#18
PERMEATE FLOW RATE
FIT121
IN8+
F121 P
IN
FIT121
+
DC COM
W
BRN
BLU
FIT121
FIT121
-
SM2004
#18
CONCENTRATE FLOW RATE
FIT122
IN9+
F122 P
IN
FIT122
+
DC COM
W
BRN
BLU
FIT122
FIT122
-
SM0504
+
#18
VSEP #3 4-20mA Signals
24 VDC
from F5
1-3
105 R
F5
#18
FEED PRESSURE
PIT130
IN10+
P130 P
IN
PIT130
+
DC COM
W
BRN
BLU
PIT130
PIT130
-
PN2222
#18
PERMEATE PRESSURE
PIT131
IN11+
P131 P
IN
PIT131
+
DC COM
W
BRN
BLU
PIT131
PIT131
-
PN2222
#18
CONCENTRATE PRESSURE
PIT132
IN12+
P132 P
IN
PIT132
+
DC COM
W
BRN
BLU
PIT132
PIT132
-
PN2222
+
#18
VSEP #3 4-20mA Signals
24 VDC
from F6
1-3
106 R
F6
#18
PERMEATE FLOW RATE
FIT131
IN13+
F131 P
IN
FIT131
+
DC COM
W
BRN
BLU
FIT131
FIT131
-
SM2004
#18
CONCENTRATE FLOW RATE
FIT132
IN14+
F132 P
IN
FIT132
+
DC COM
W
BRN
BLU
FIT132
FIT132
-
SM0504
IN15+
NEW LOGIC RESEARCH
Series i Electrical Schematic
PLC_3bAI
SIGNATURES
DATE
ELECTRICAL ENGINEER KWK 7/9/13
ELECTRICAL MANAGER EB 11/22/13
SIZE A
DWG NO. 1-11
FILE iEL 4-440-60-ac SDL
REV
PROJECT: Santo Domingo Landfill-MAIN
SHEET 11 of 49



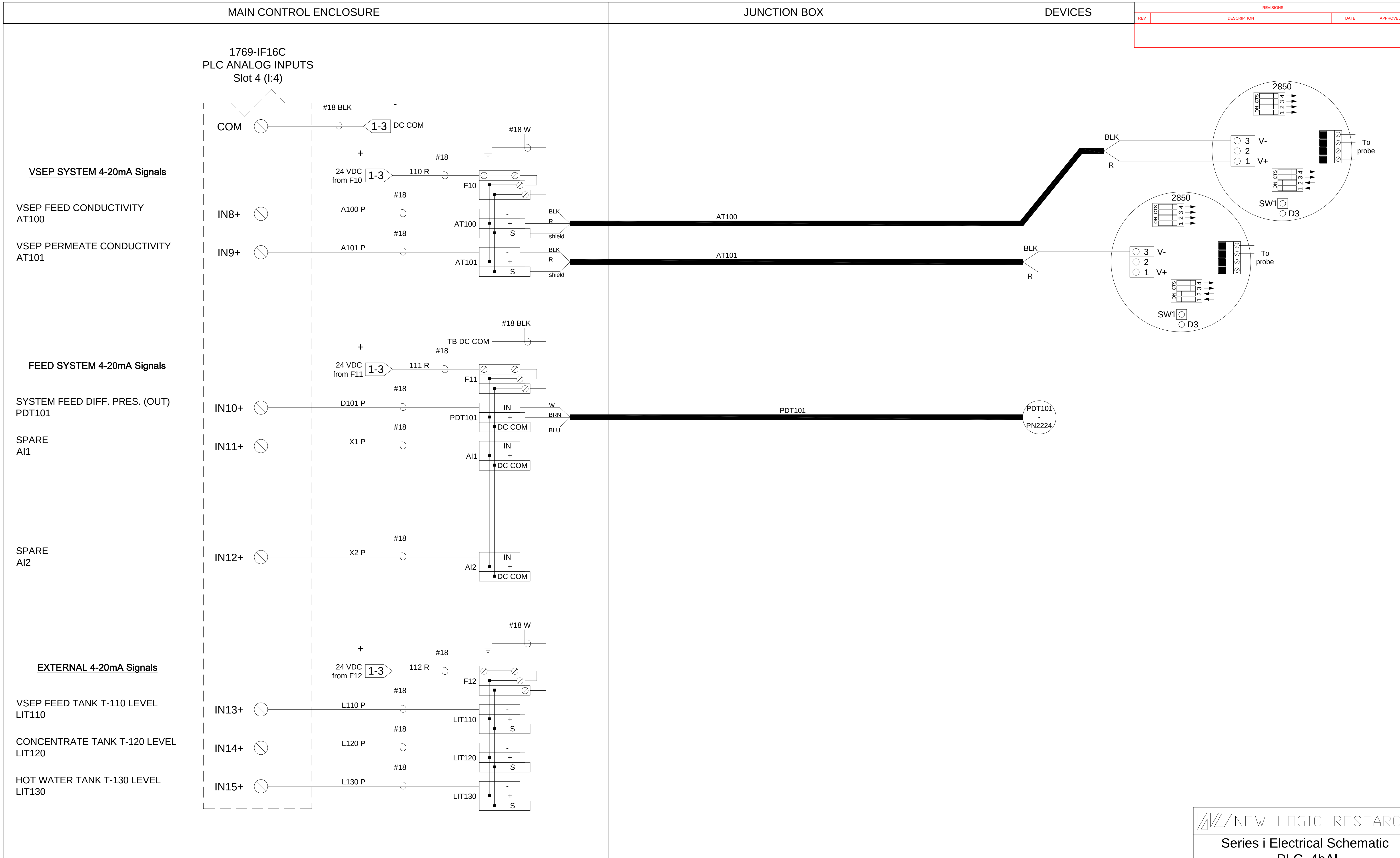
REV	DESCRIPTION	DATE	APPROVED

REVISIONS

NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_4aAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-12	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET	12 of 49



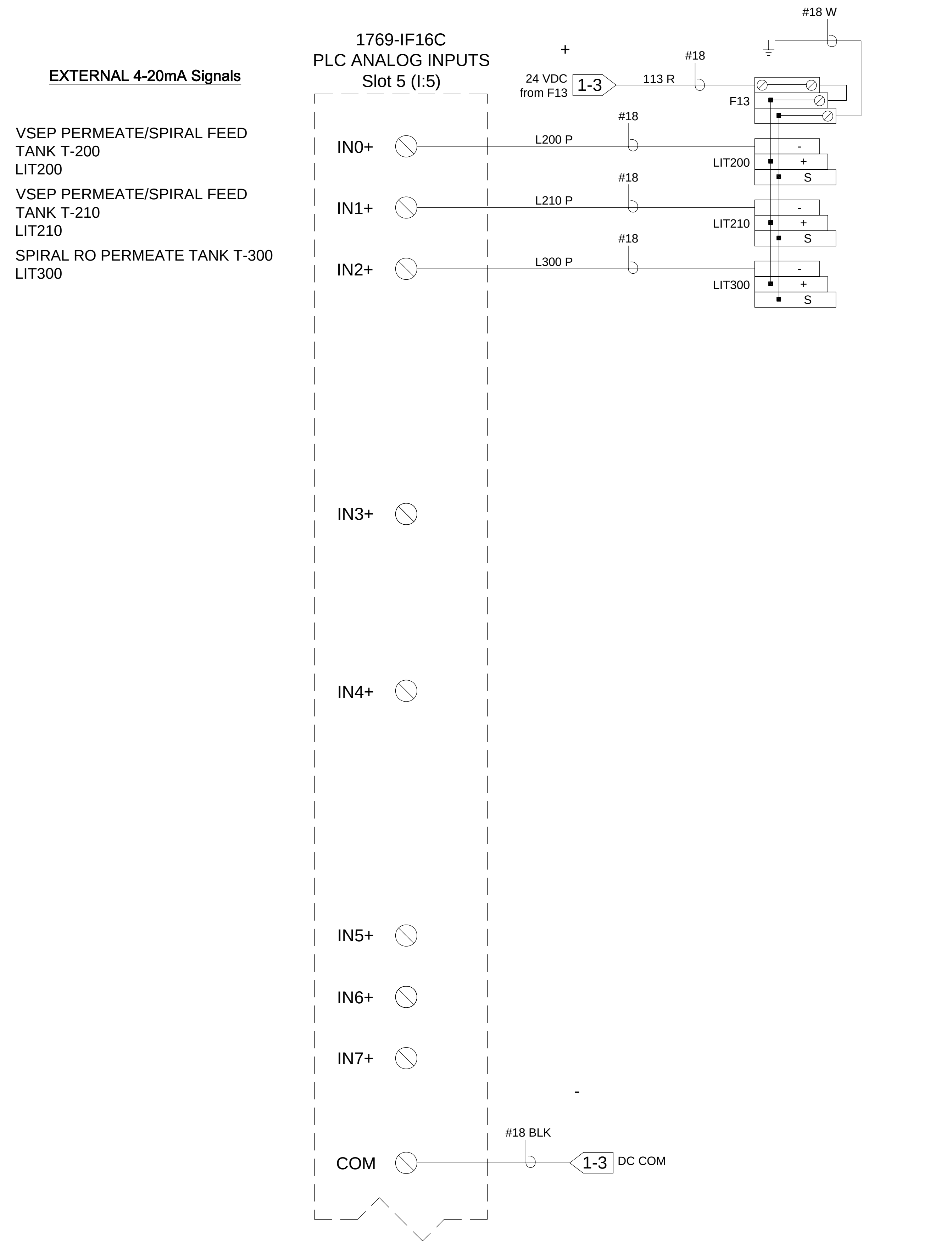
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_4bAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-13	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET 13 of 49	

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



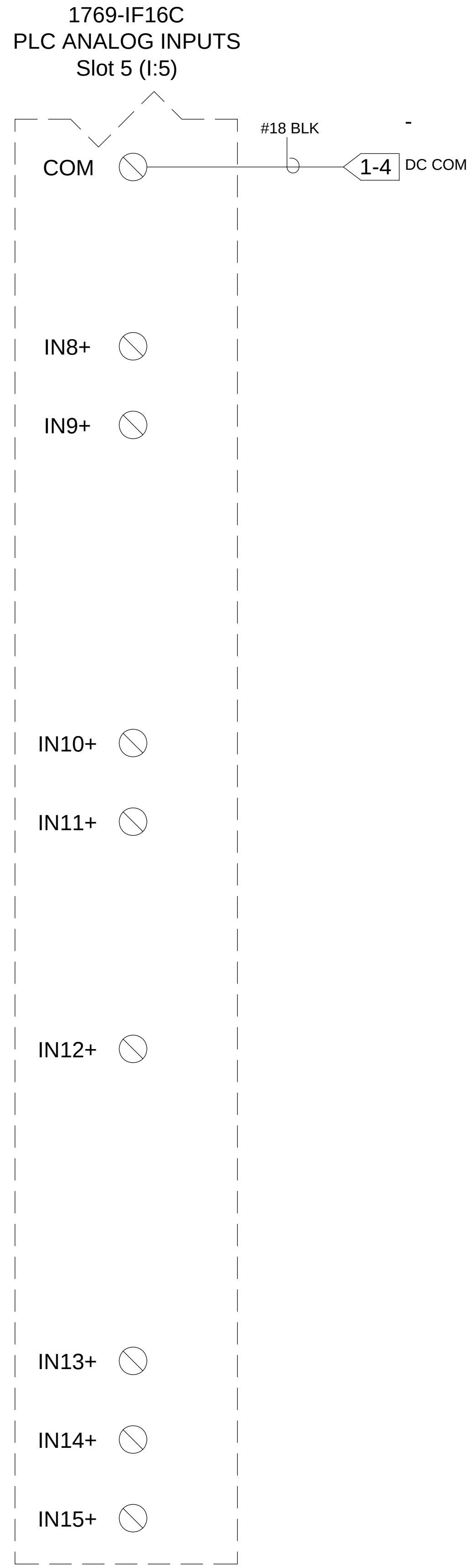
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_5aAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-14	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET	14 of 49

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



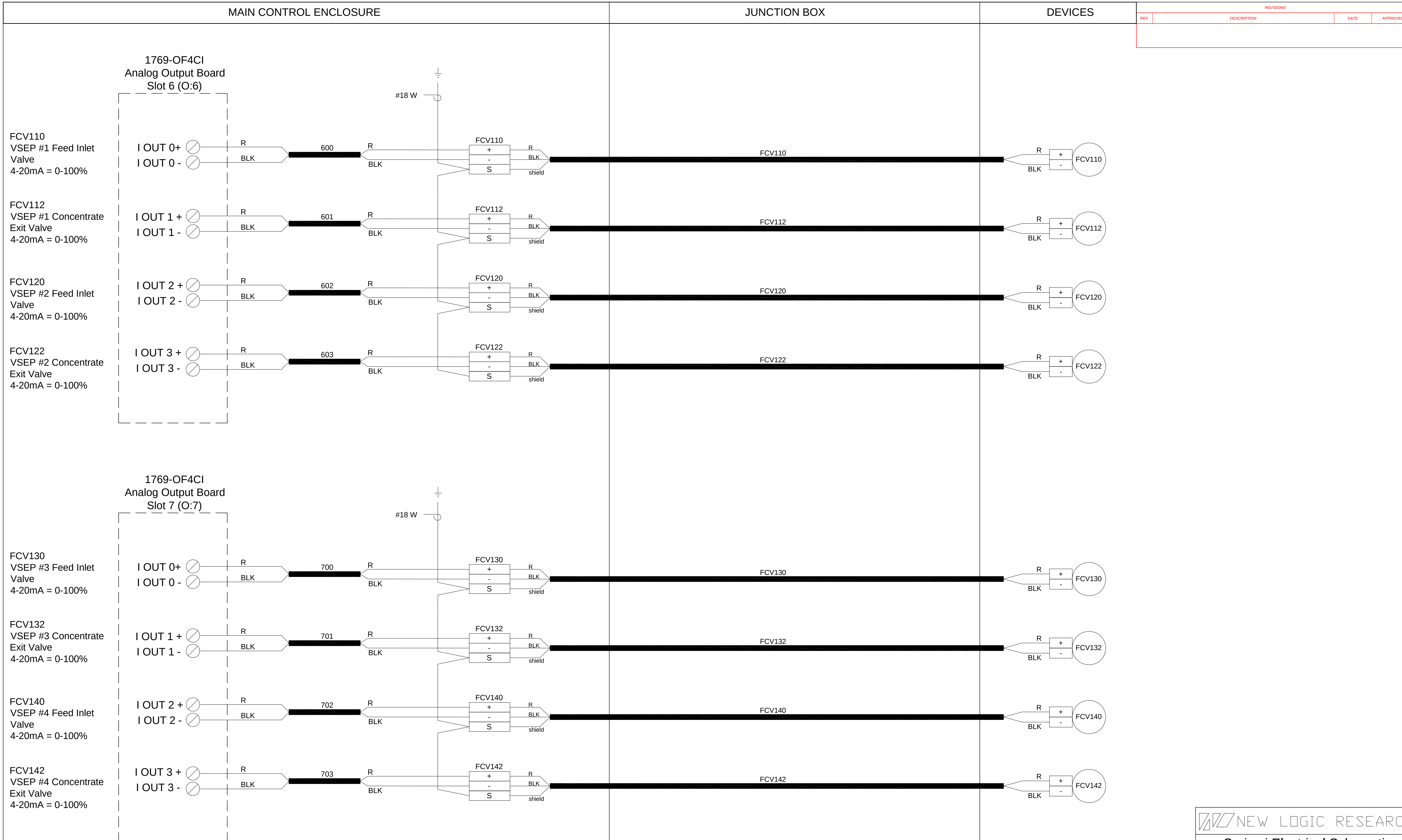
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_5bAI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-15	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 15 of 49



NOTE: Terminate end of communication bus with a right end cap (1769-ECR)

NEW LOGIC RESEARCH

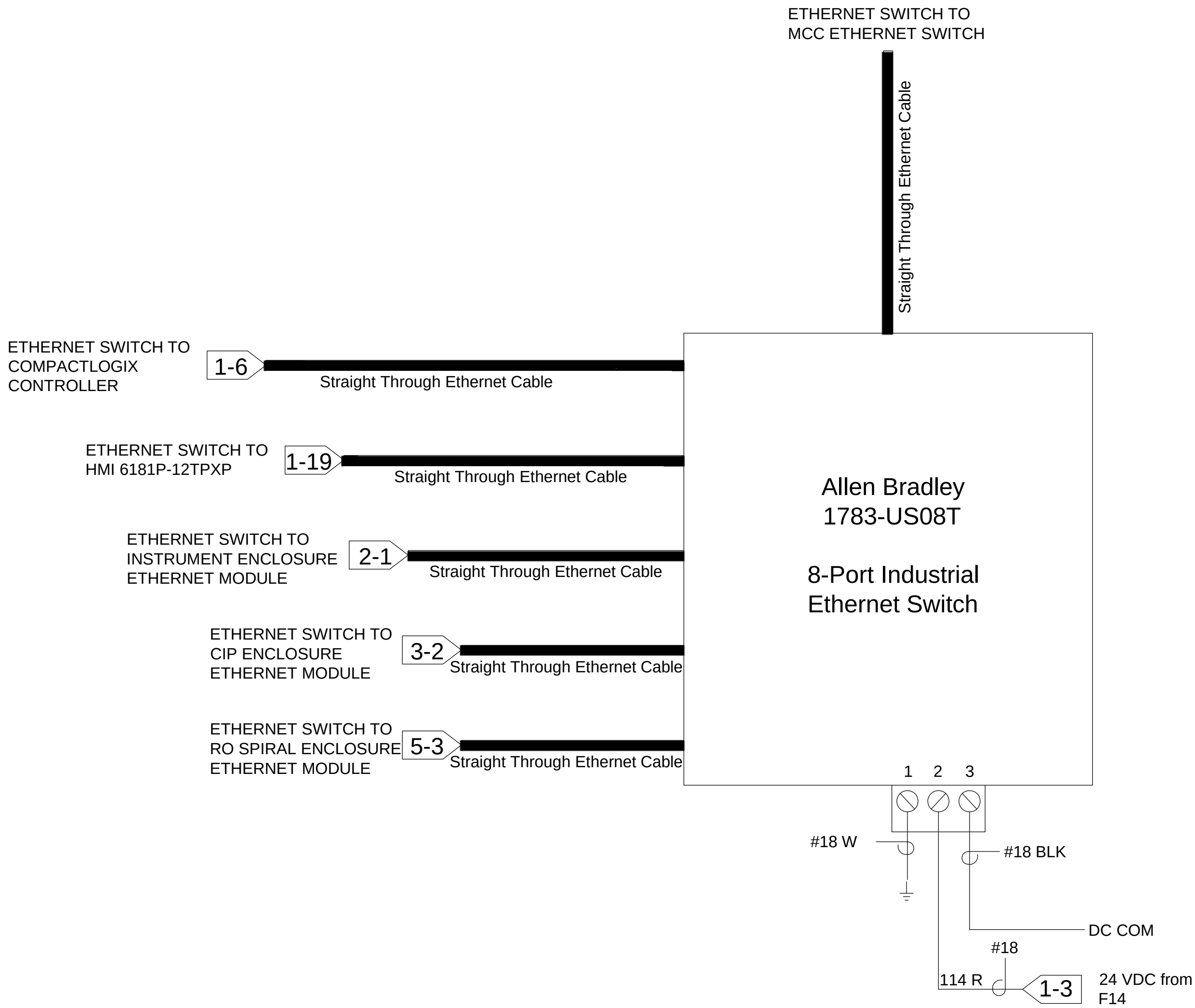
Series i Electrical Schematic
PLC_6-7AO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE A | DWG NO. 1-16 | FILE iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 16 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

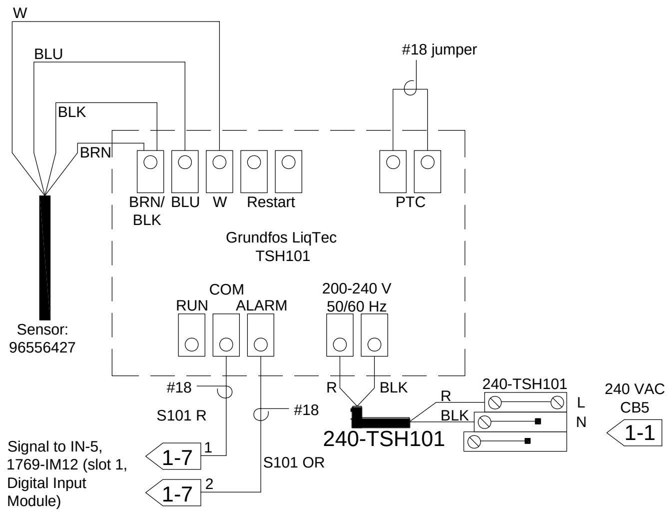
Series i Electrical Schematic
Ethernet Switch

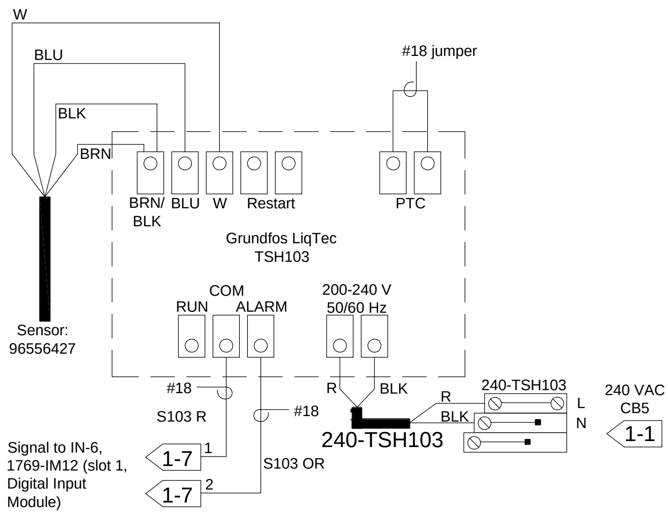
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-17	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED





NEW LOGIC RESEARCH

Series i Electrical Schematic
Pump Seal Switch

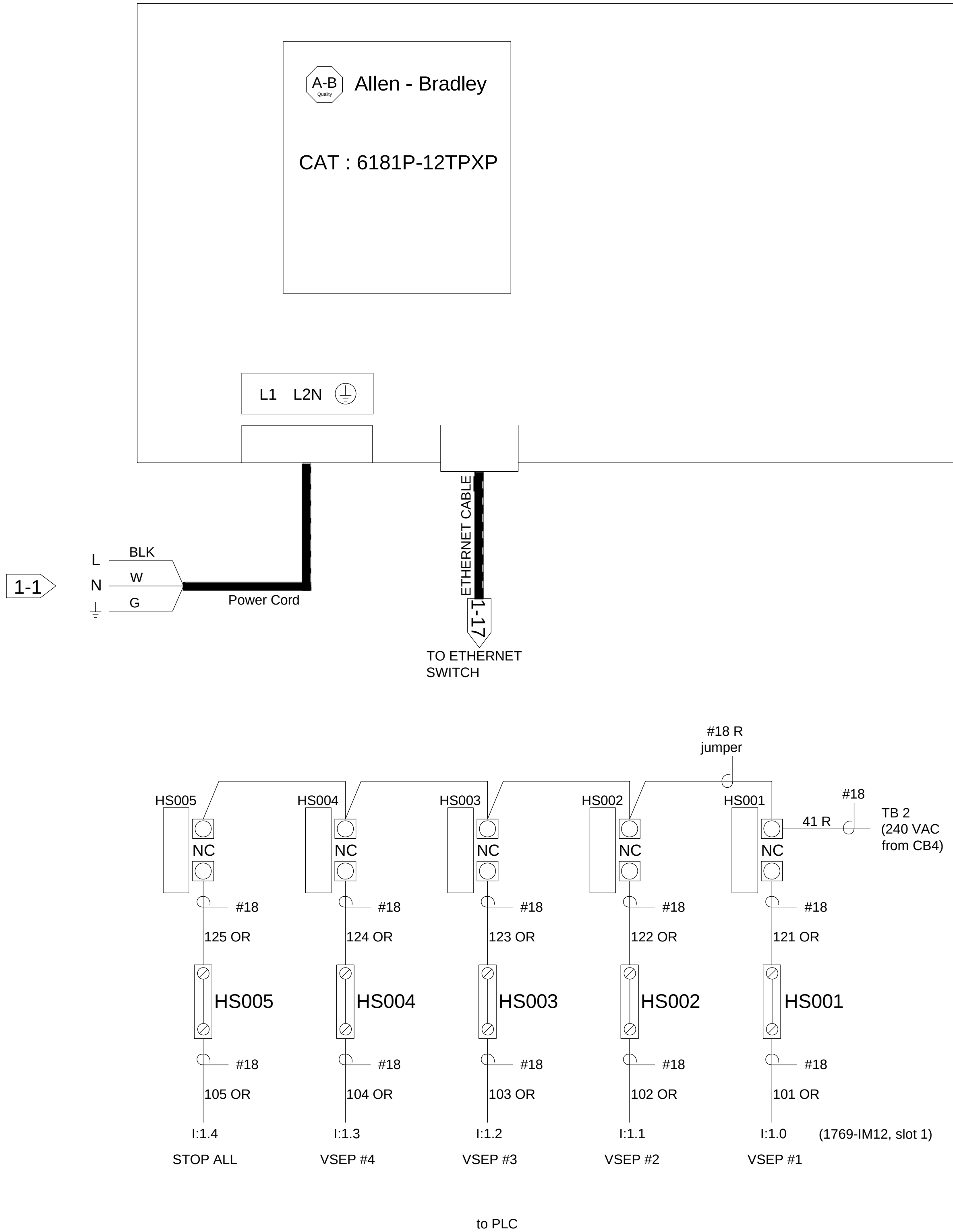
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-18	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

Allen Bradley Industrial Computer (HMI)



COMPONENTS ON DOOR

NEW LOGIC RESEARCH

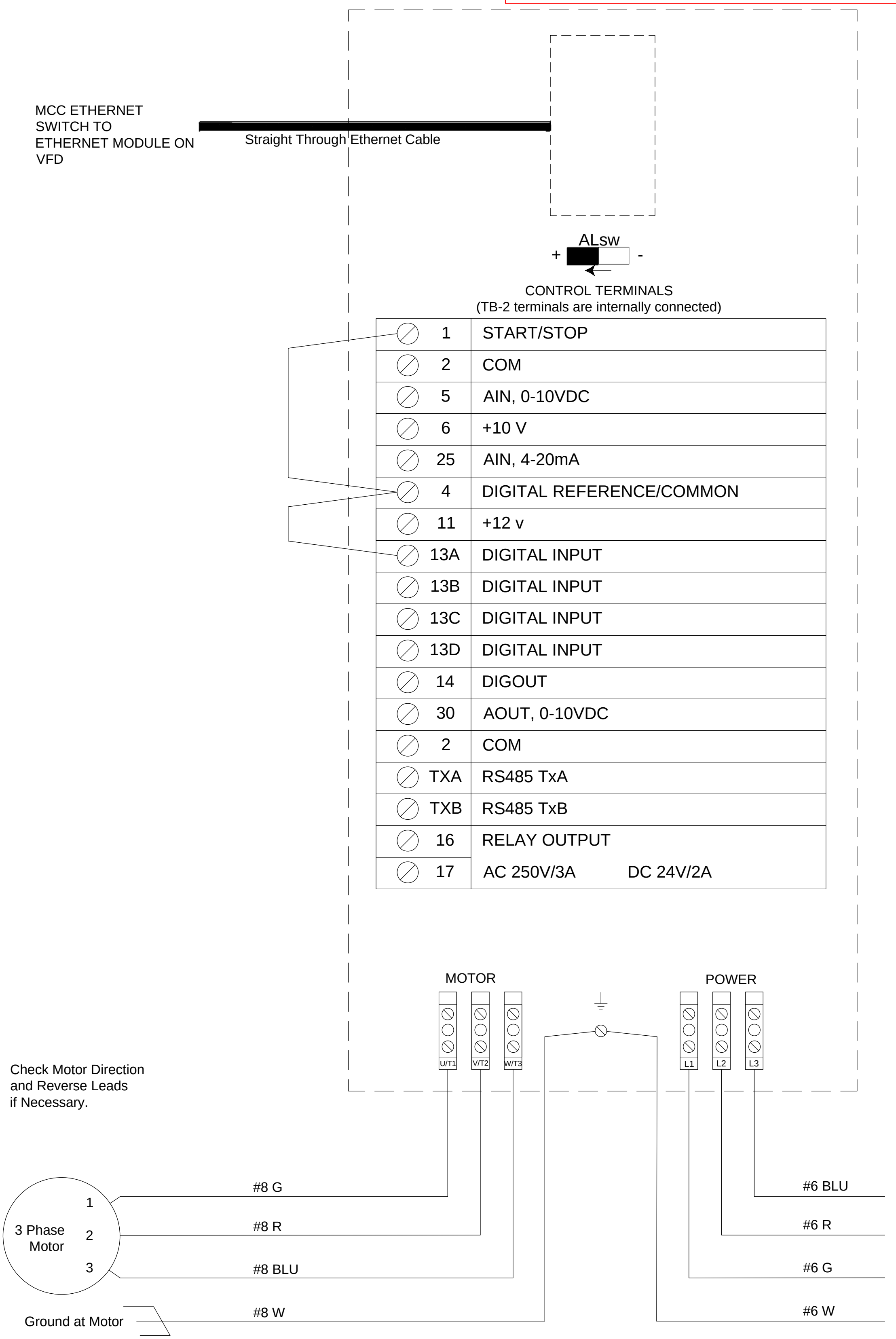
Series i Electrical Schematic
Main Enclosure Door

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-19	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 19 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P100 VFD
AC Tech ESV183 25HP, 440 VAC

NEW LOGIC RESEARCH

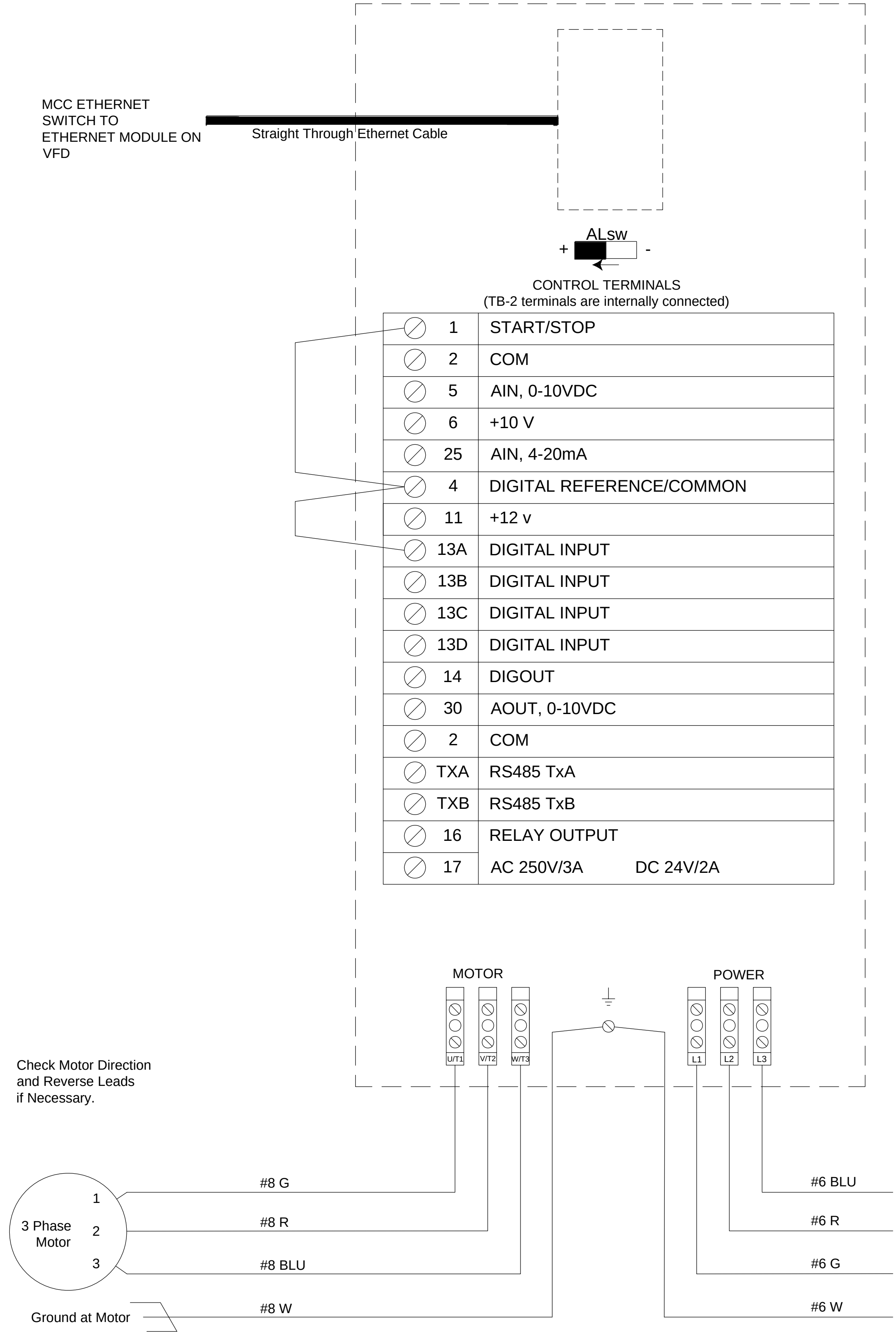
Series i Electrical Schematic
M-P100 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-20	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 20 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P101 VFD
AC Tech ESV183 25HP, 440 VAC

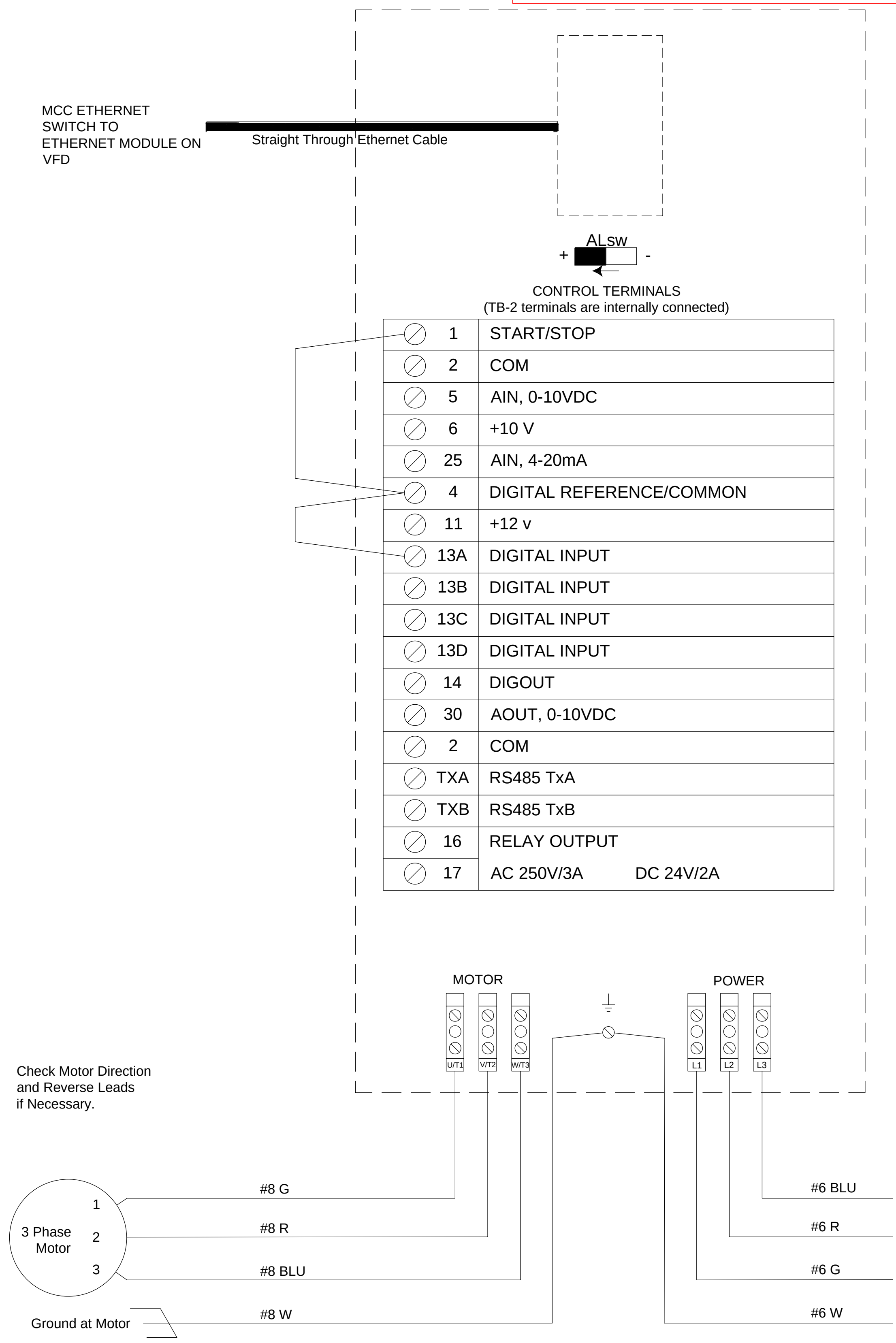
NEW LOGIC RESEARCH

Series i Electrical Schematic
M-P101 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-21	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 21 of 49



VSEP FEED PUMP MOTOR M-P102 VFD
AC Tech ESV183 25HP, 440 VAC

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

Series i Electrical Schematic
M-P102 VFD

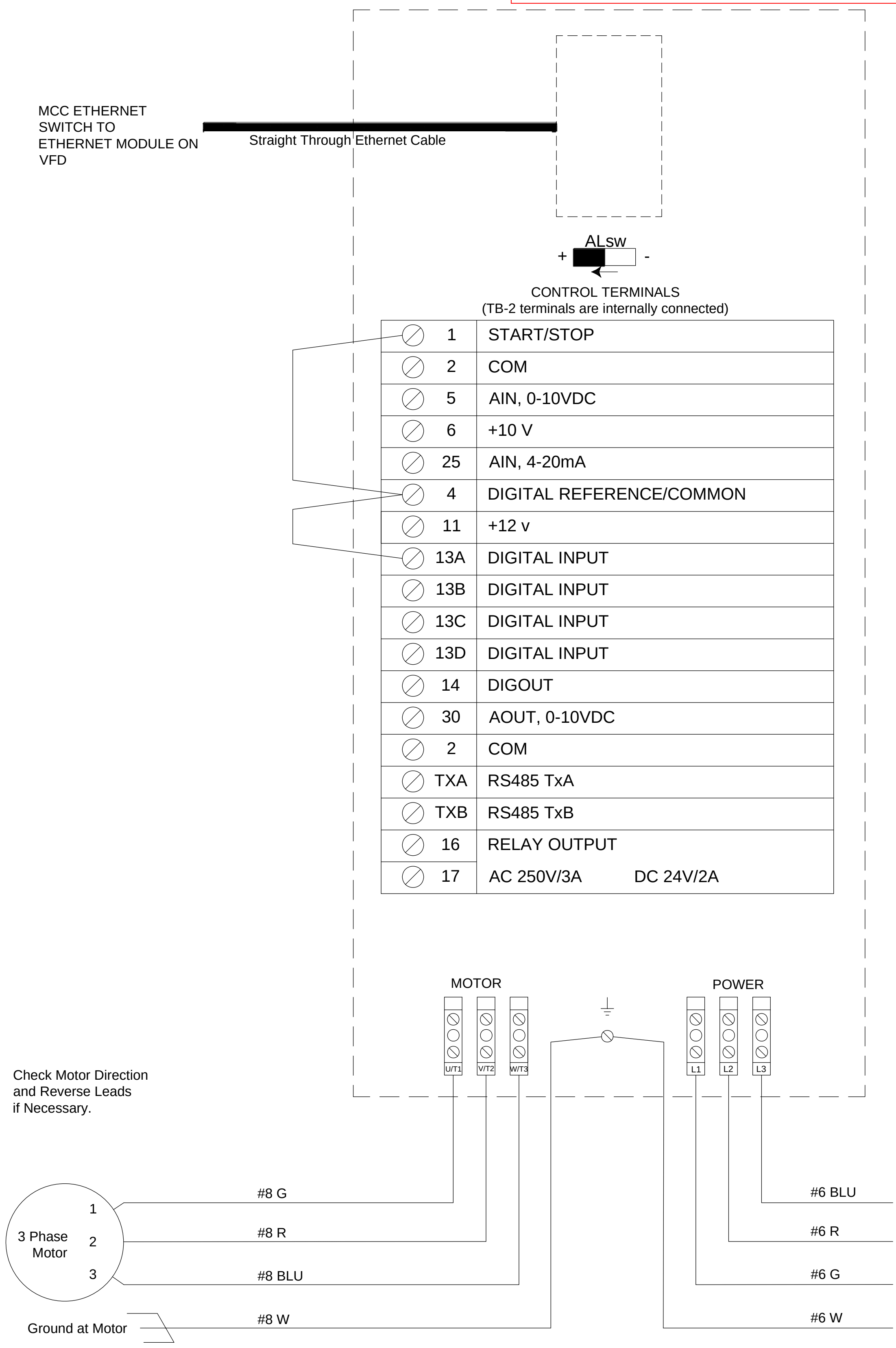
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-22	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P103 VFD
AC Tech ESV183 25HP, 440 VAC

NEW LOGIC RESEARCH

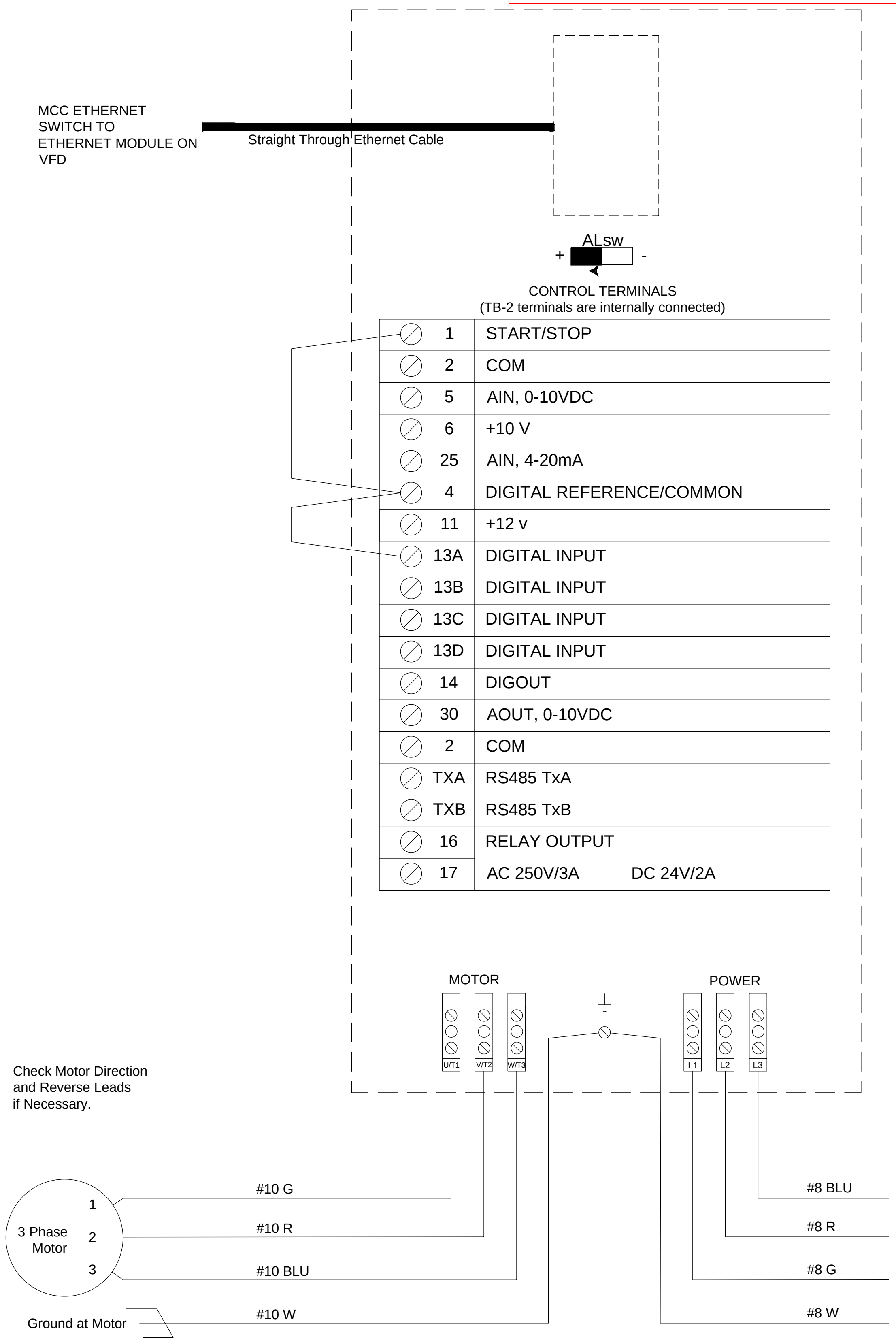
Series i Electrical Schematic
M-P103 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE A | DWG NO. 1-23 | FILE iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 23 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



CIP FEED PUMP MOTOR M-P190 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

Series i Electrical Schematic
M-P190 VFD

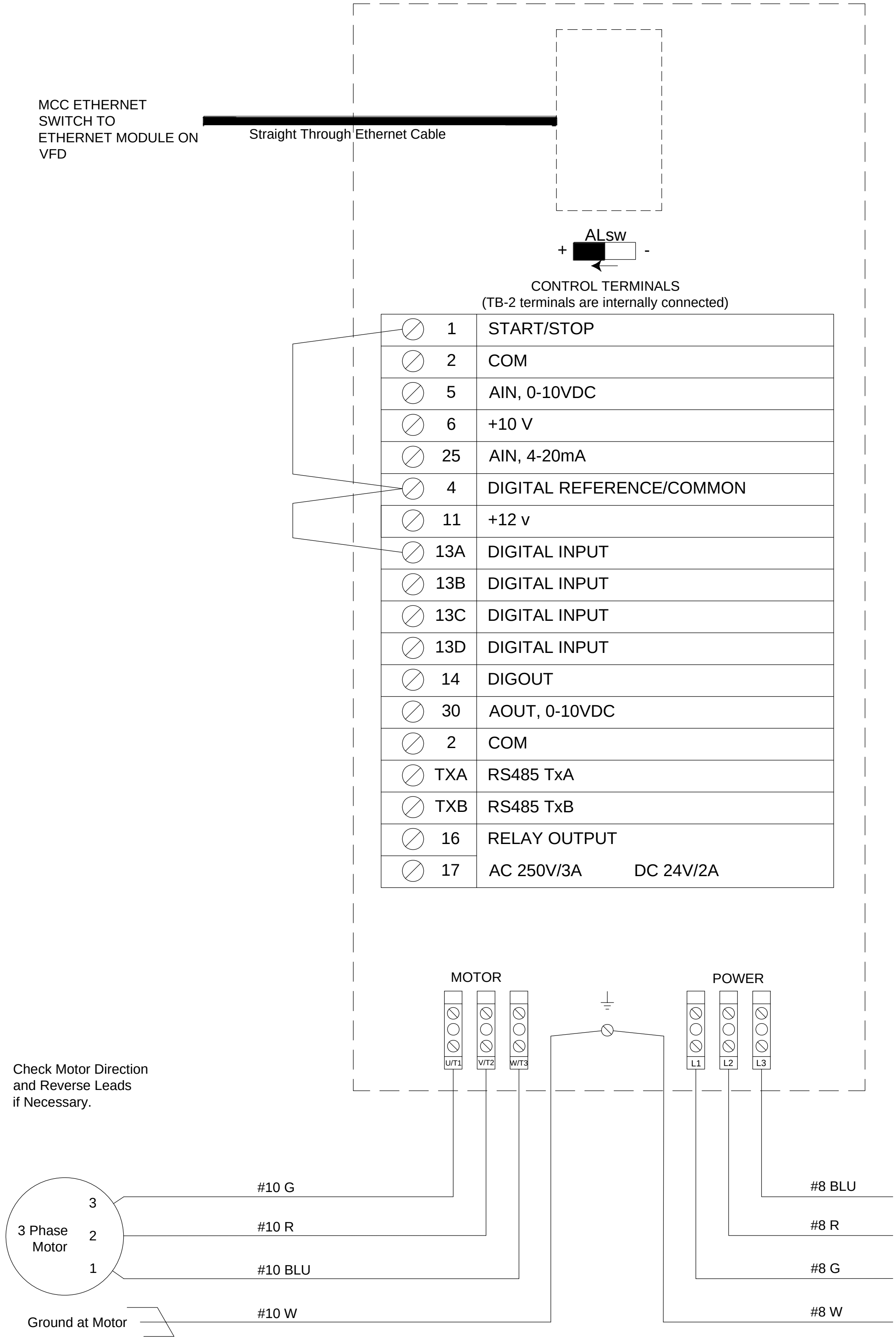
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-24	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 24 of 49

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V110 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

Series i Electrical Schematic
M-V110 VFD

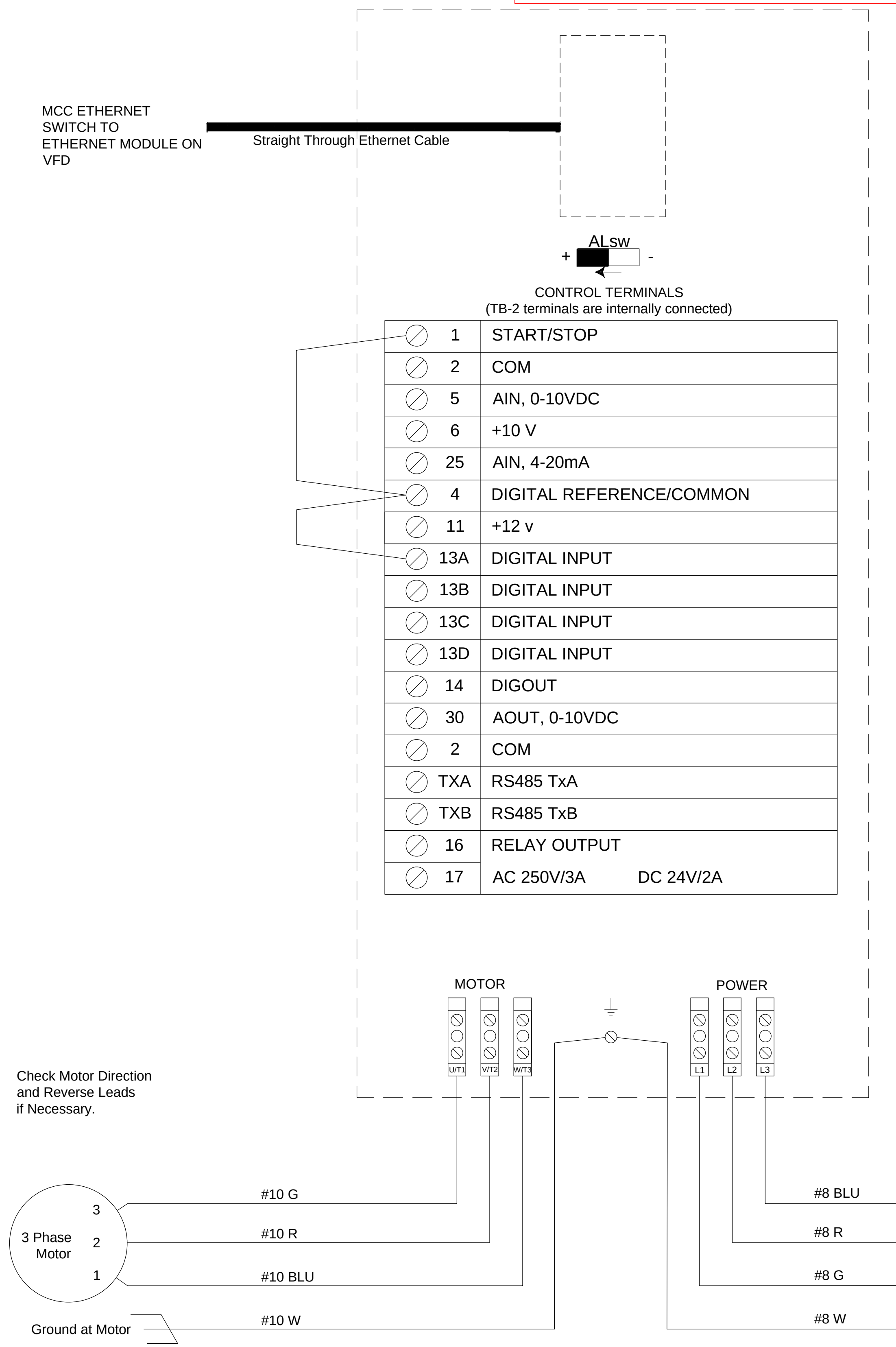
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-25	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

SHEET 25 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V120 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

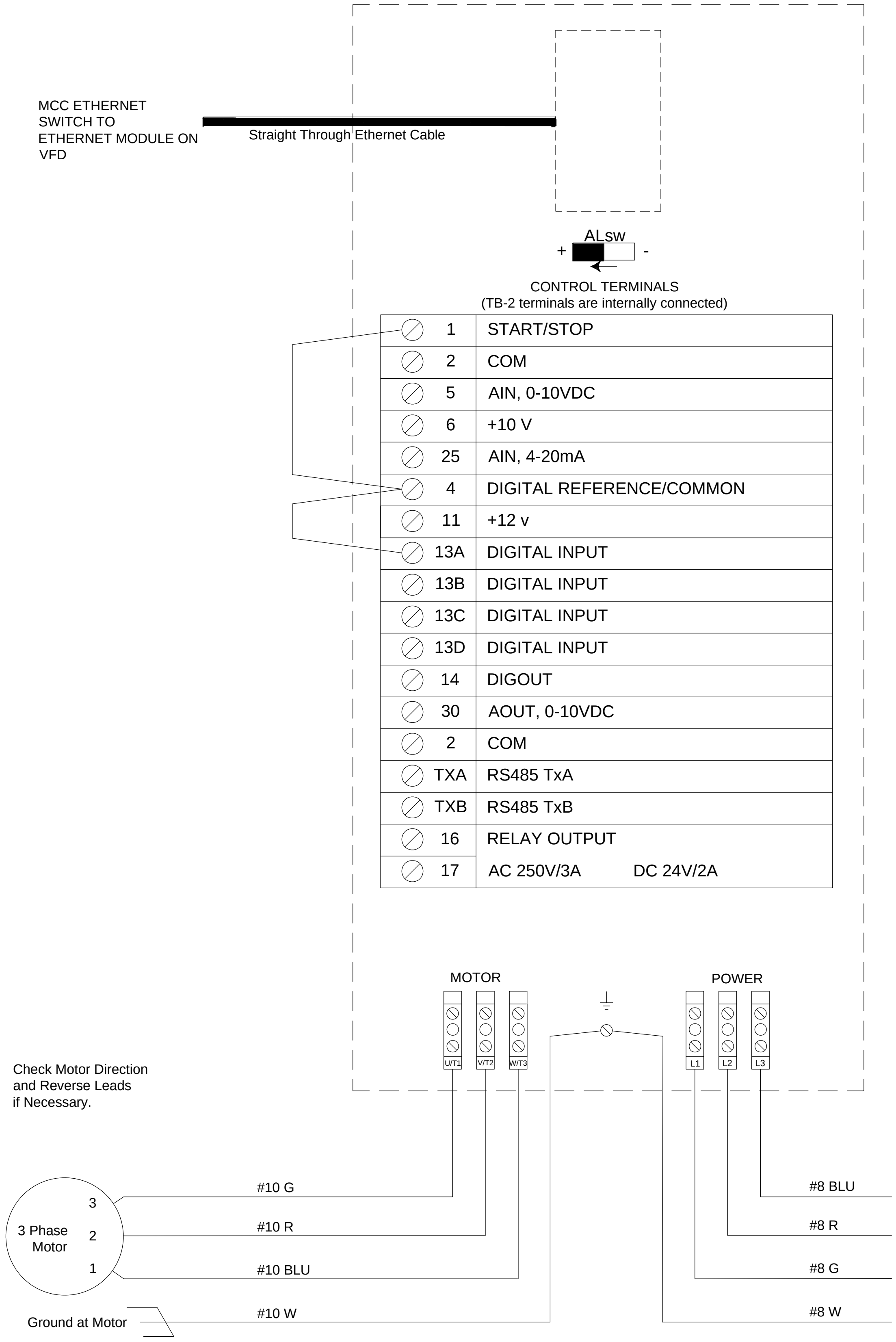
Series i Electrical Schematic
M-V120 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-26	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 26 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V130 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

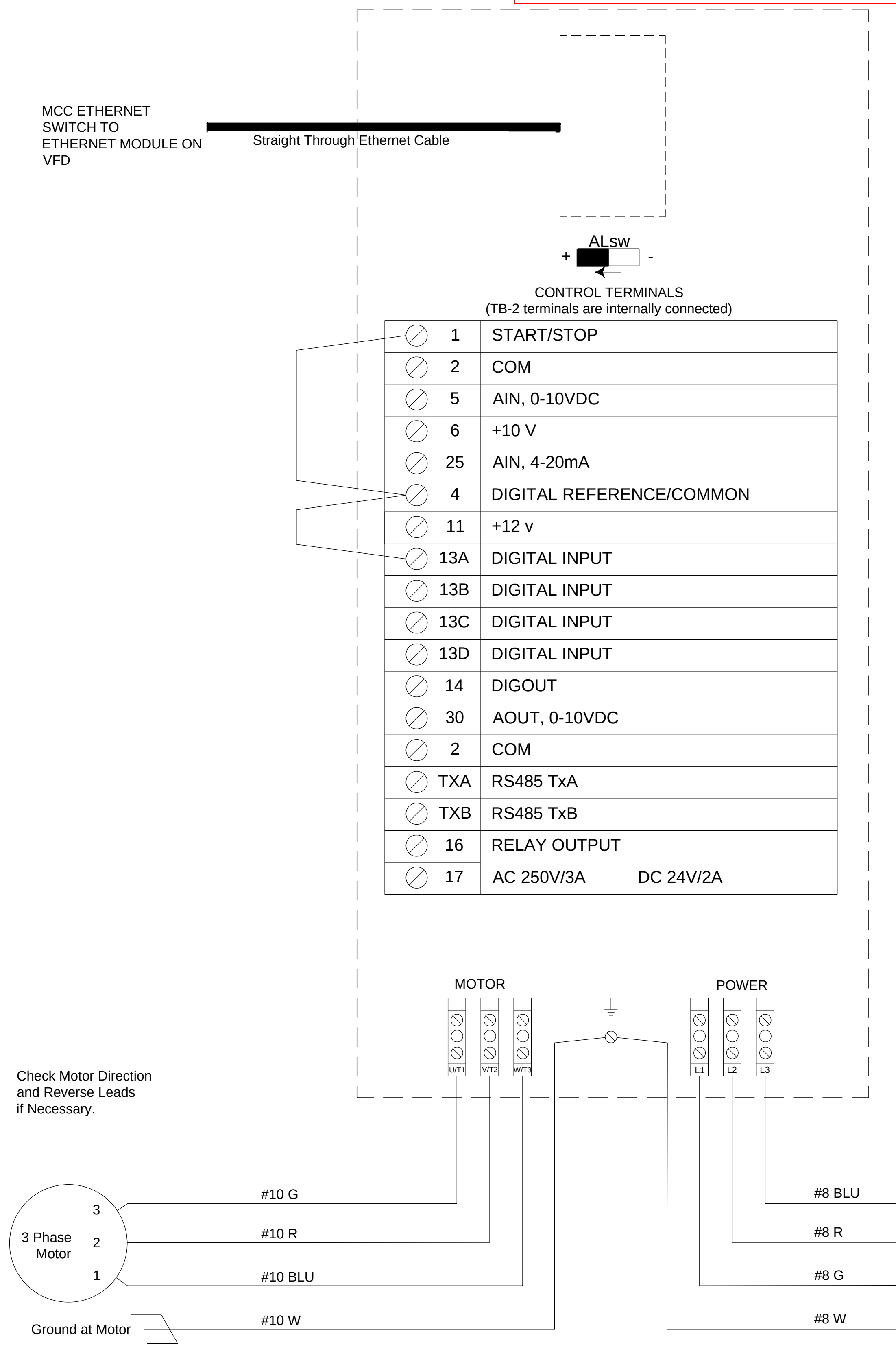
Series i Electrical Schematic
M-V130 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-27	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 27 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V140 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

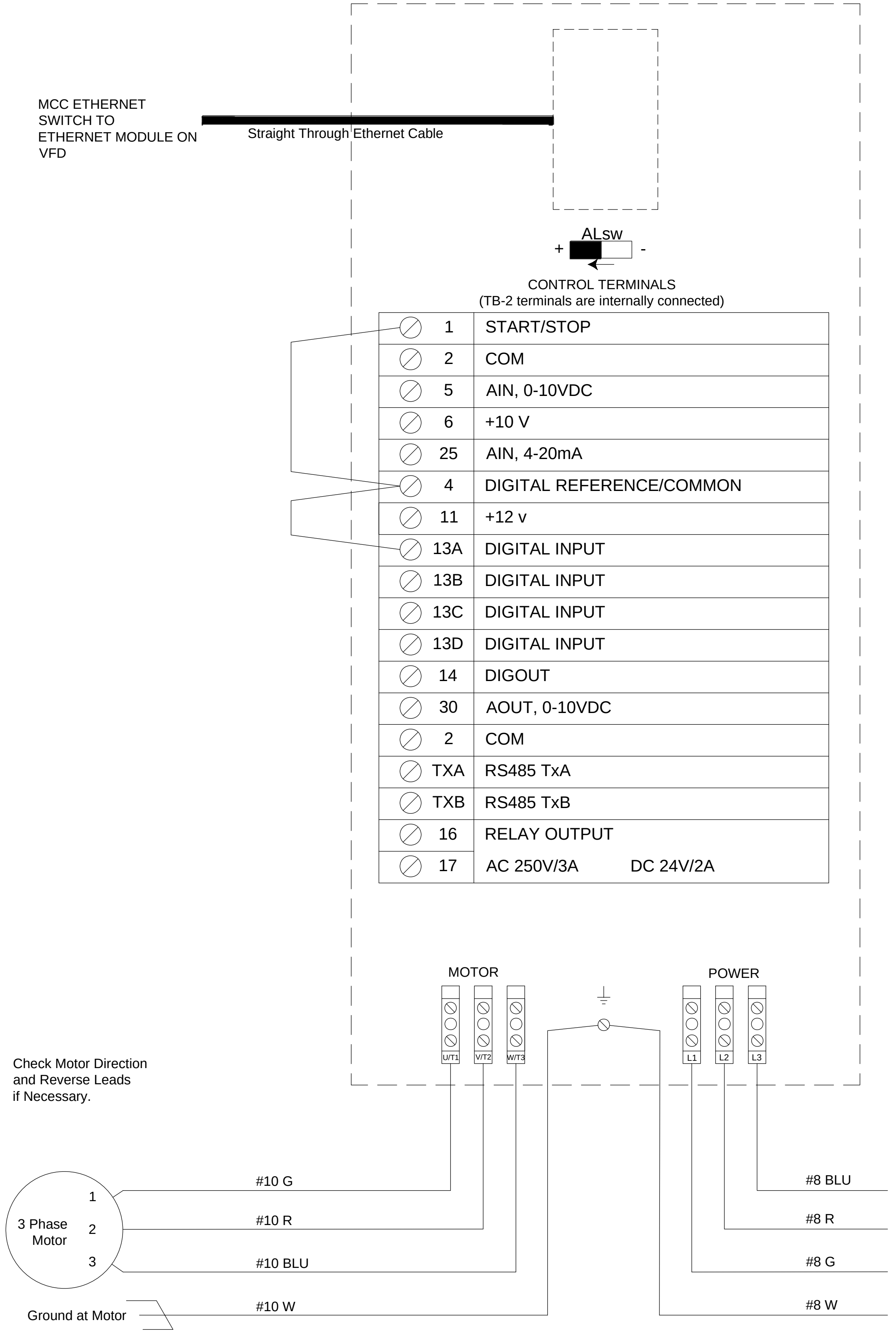
Series i Electrical Schematic
M-V140 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE: A | DWG NO.: 1-28 | FILE: iEL 4-440-60-ac SDL | REV:

PROJECT: Santo Domingo Landfill-MAIN | SHEET: 28 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



RO SPIRAL FEED PUMP MOTOR M-P200 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

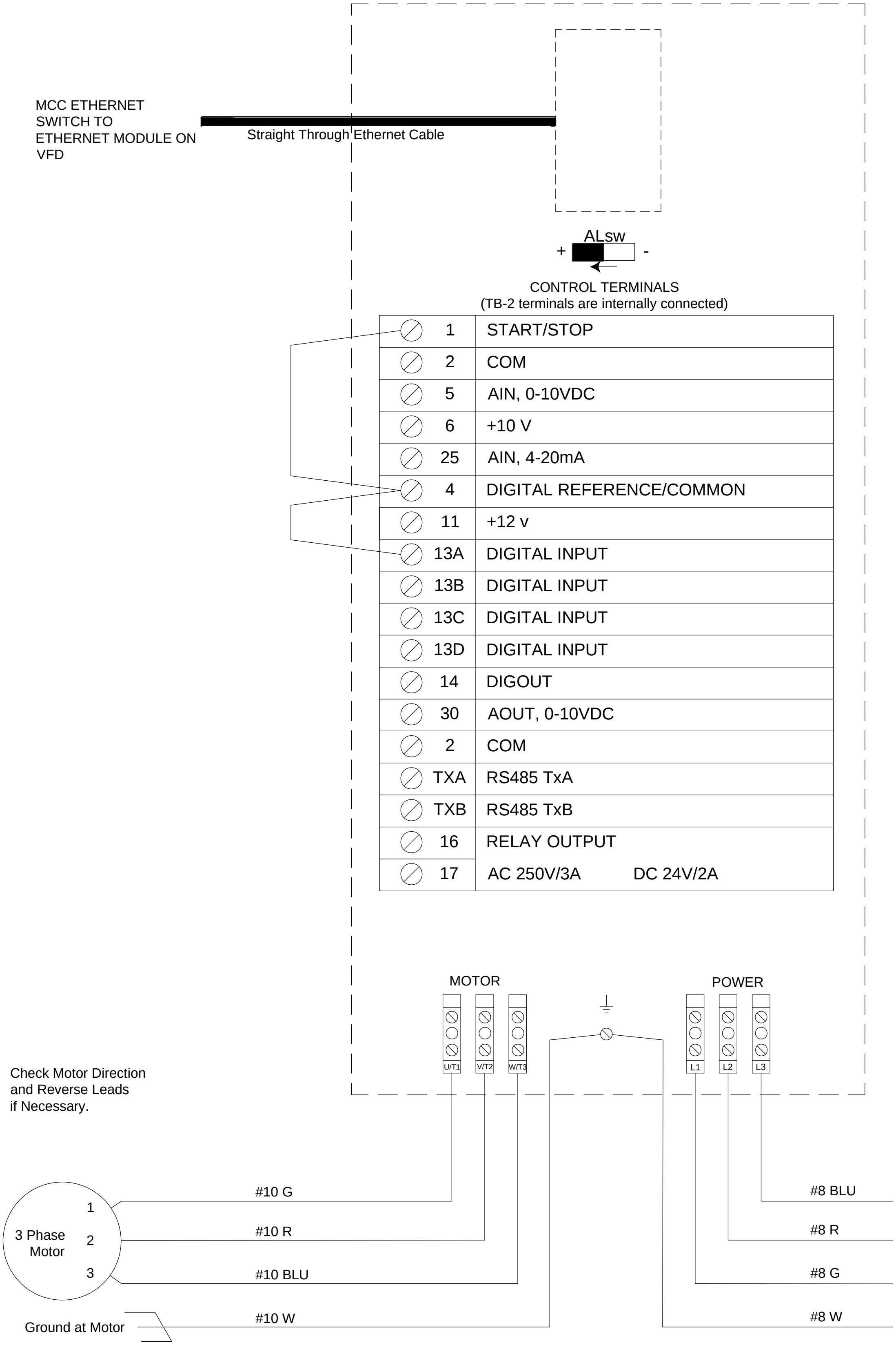
Series i Electrical Schematic
M-P200 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-29	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 29 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



1	START/STOP
2	COM
5	AIN, 0-10VDC
6	+10 V
25	AIN, 4-20mA
4	DIGITAL REFERENCE/COMMON
11	+12 v
13A	DIGITAL INPUT
13B	DIGITAL INPUT
13C	DIGITAL INPUT
13D	DIGITAL INPUT
14	DIGOUT
30	AOUT, 0-10VDC
2	COM
TXA	RS485 TxA
TXB	RS485 TxB
16	RELAY OUTPUT
17	AC 250V/3A DC 24V/2A

RO SPIRAL FEED PUMP MOTOR M-P201 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

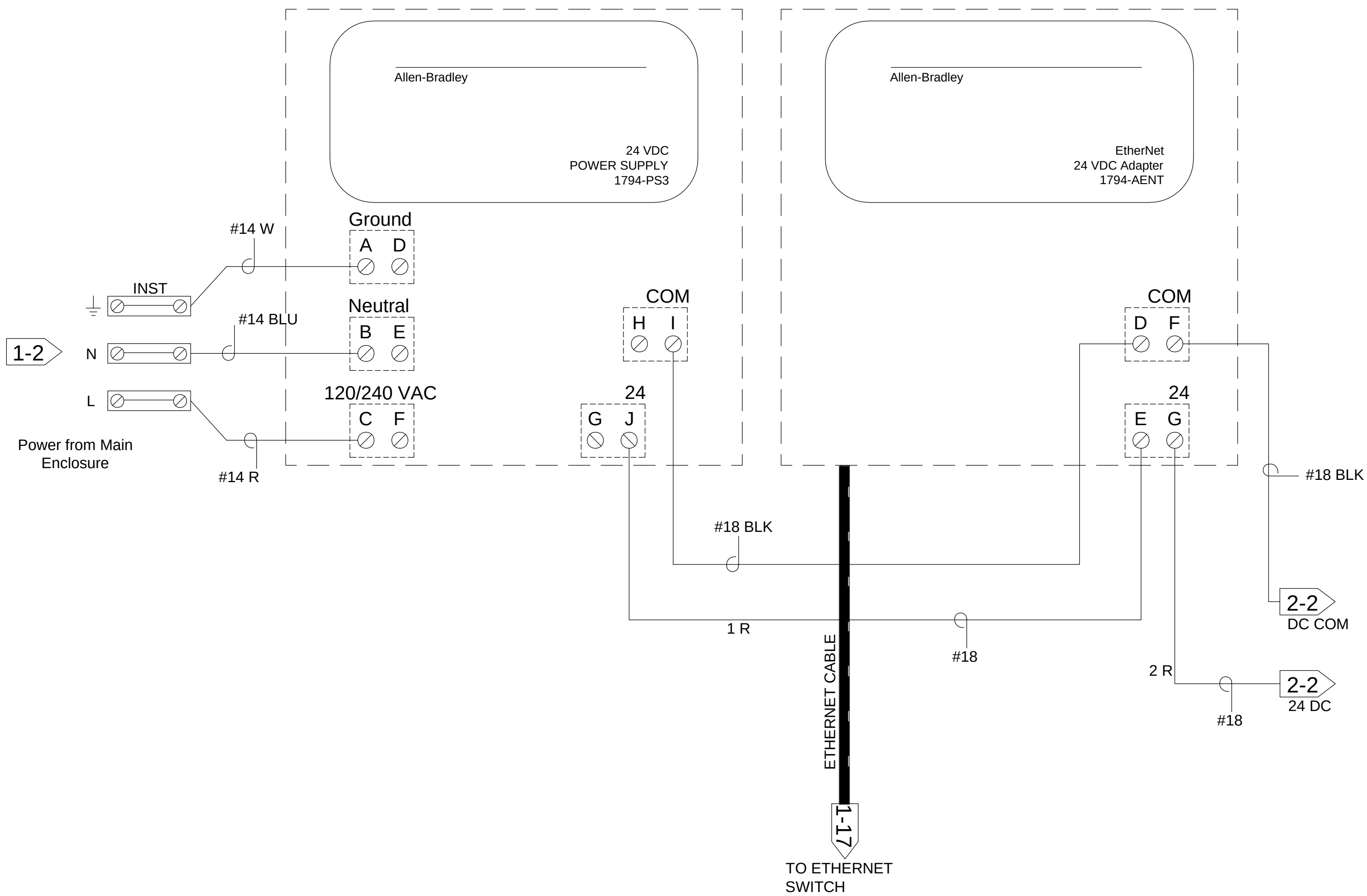
Series i Electrical Schematic
M-P201 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE A | DWG NO. 1-30 | FILE iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 30 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

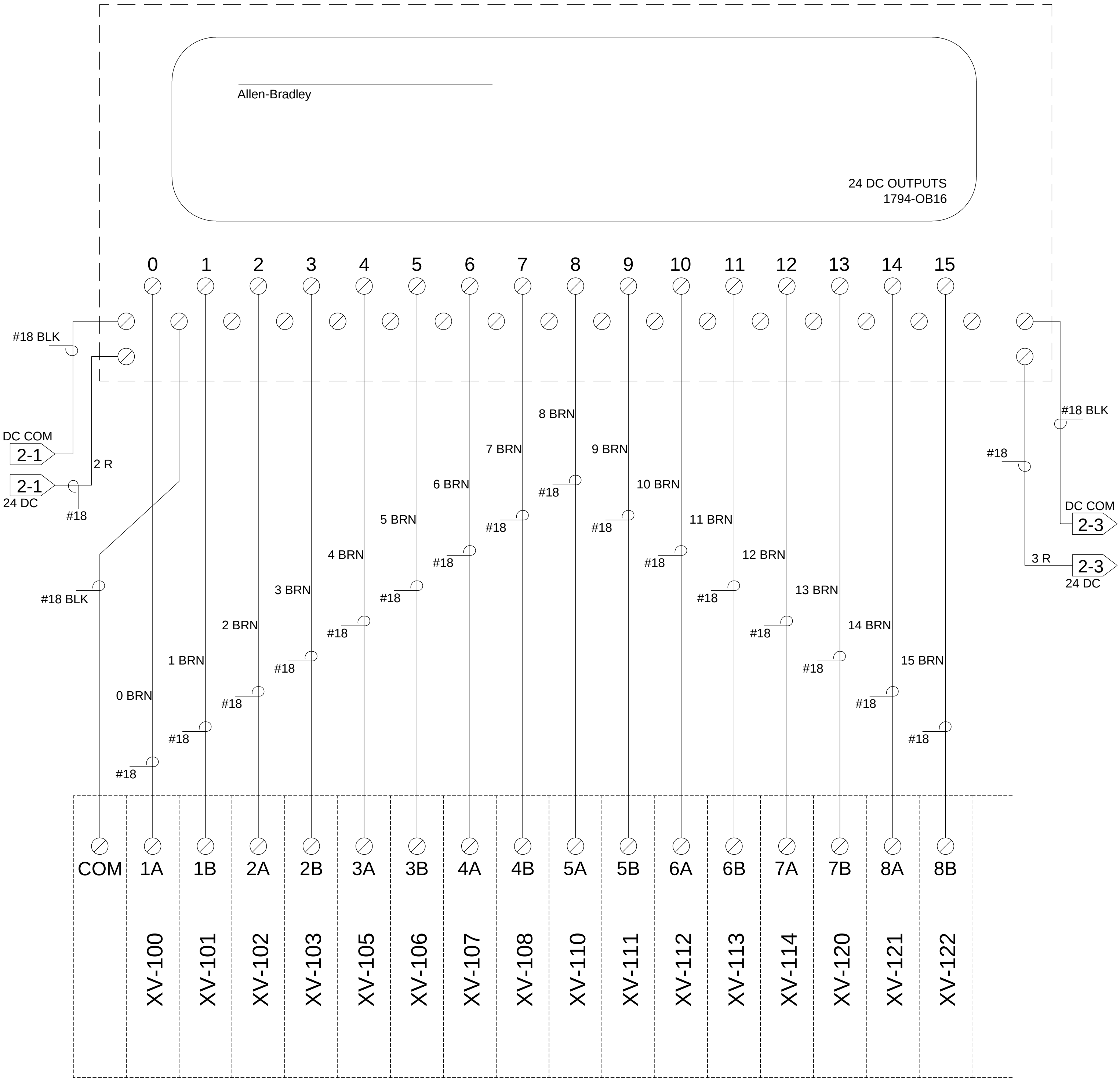
Series i Electrical Schematic
Flex IO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST SHEET 31 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Solenoid Valve Rack #1

20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

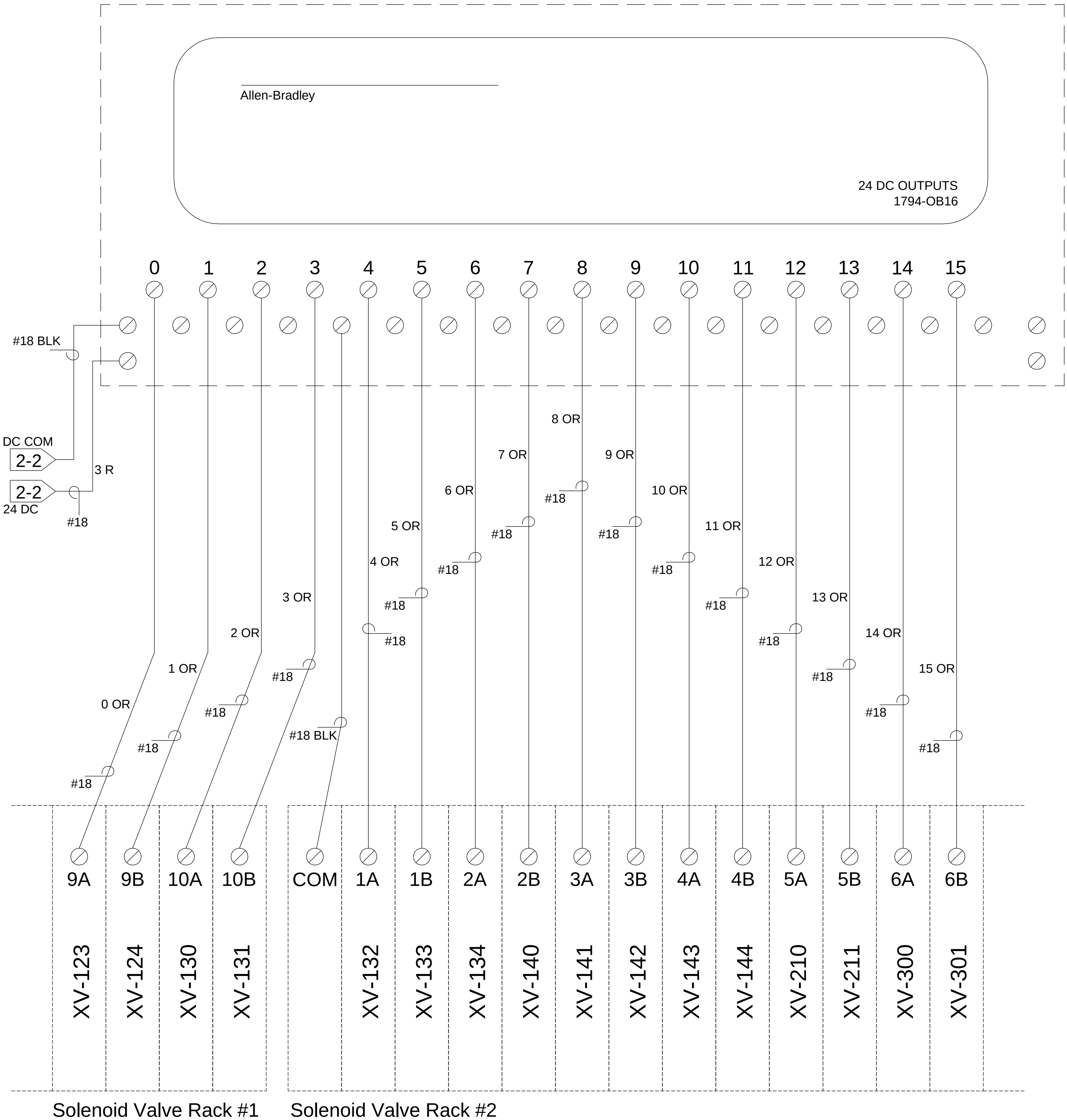
Series i Electrical Schematic
Flex IO - 1DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-2	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST SHEET 32 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

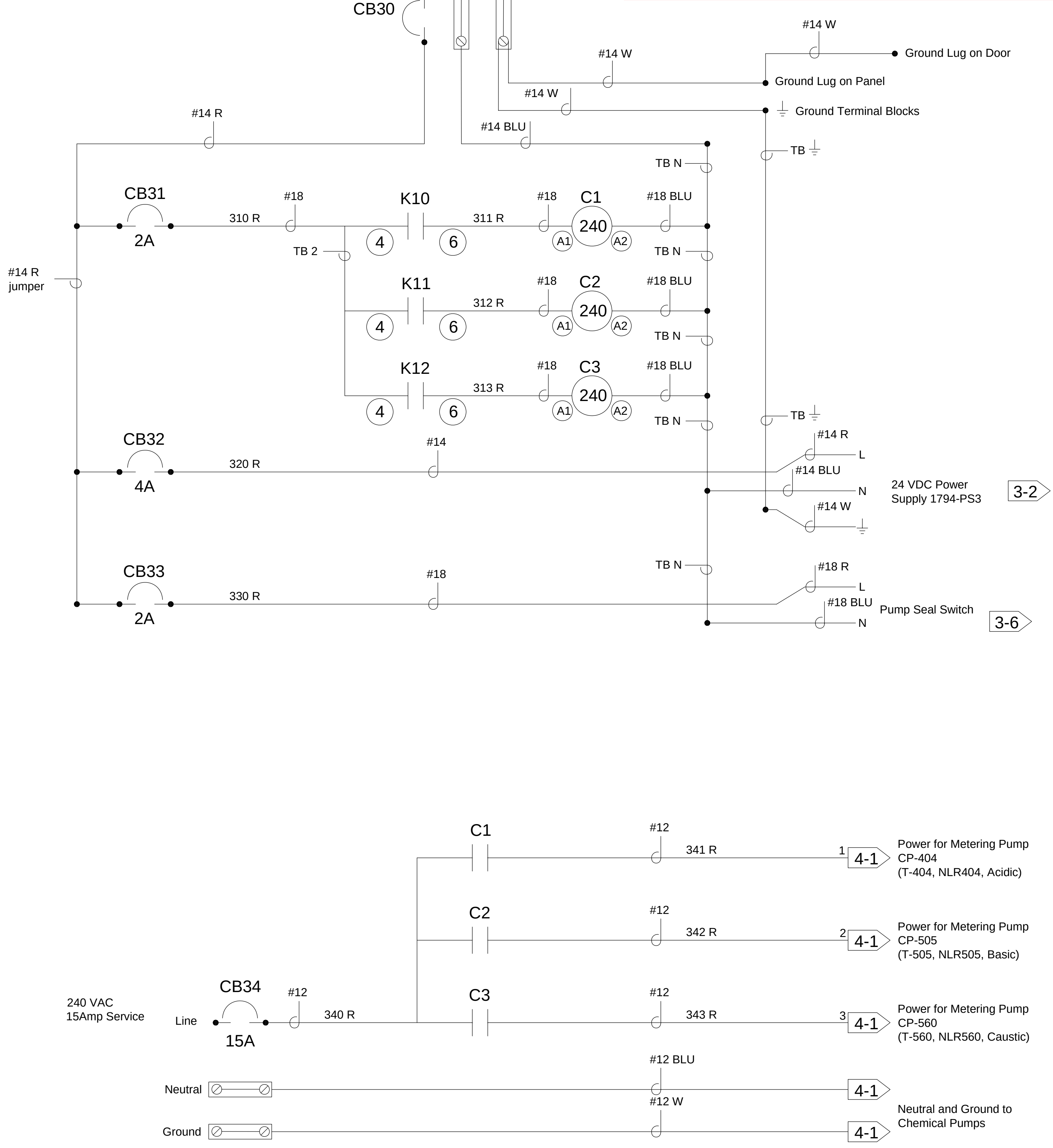
Series i Electrical Schematic
Flex IO - 2DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST SHEET 33 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

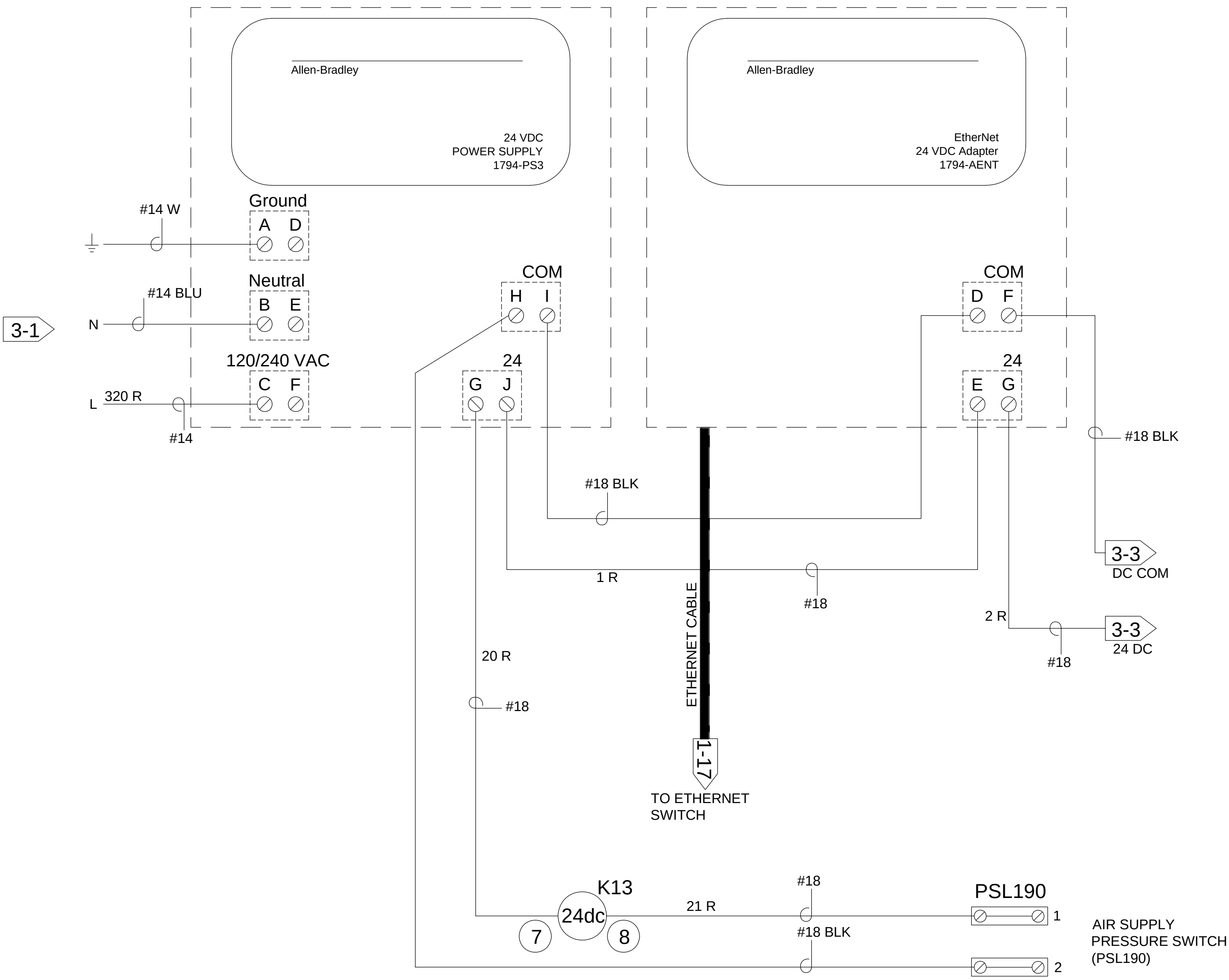
Series i Electrical Schematic
Single Phase

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP SHEET 34 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



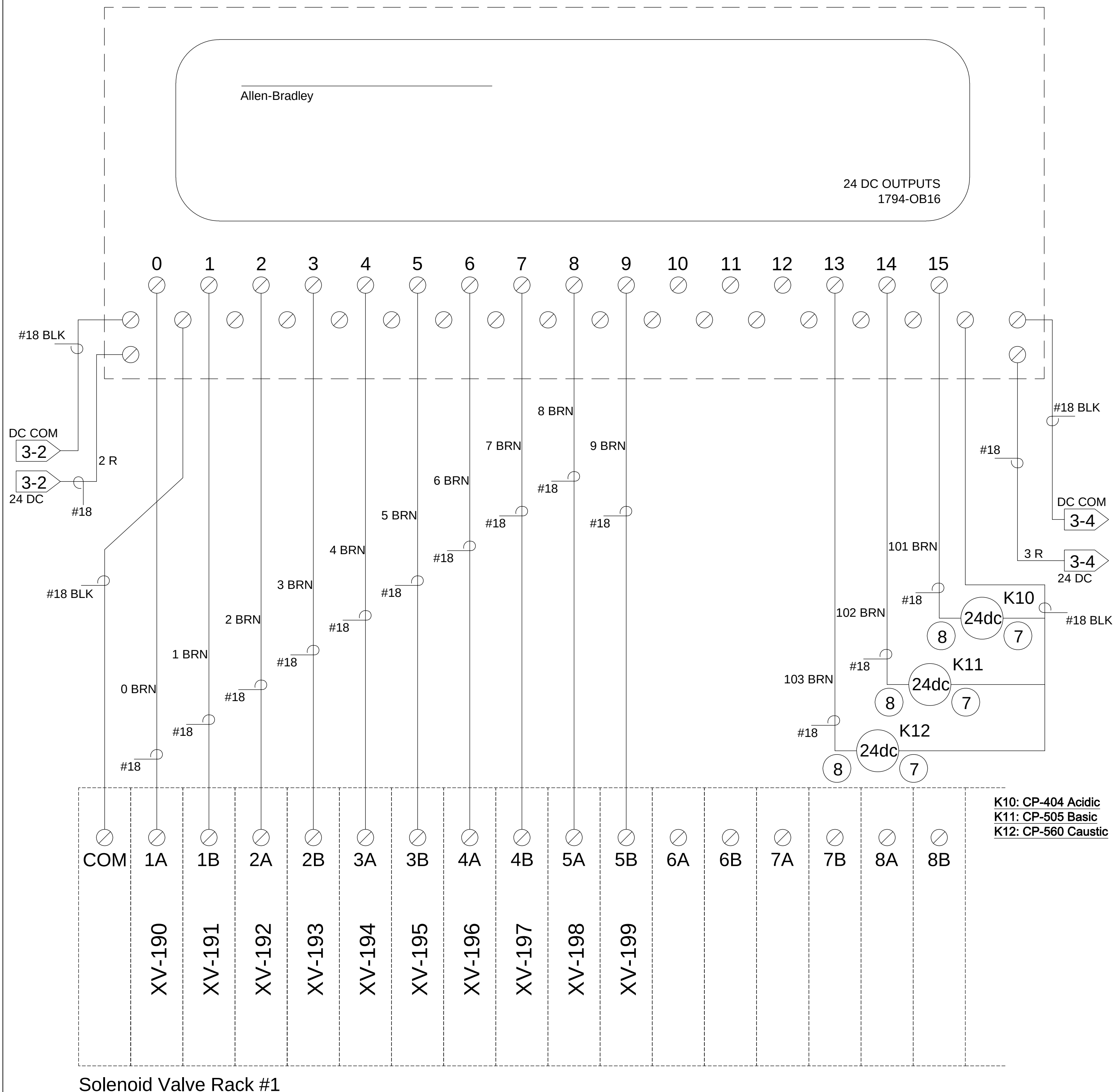
NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-2	iEL 4-440-60-ac SDL	
PROJECT:	Santo Domingo Landfill-CIP	SHEET	35 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

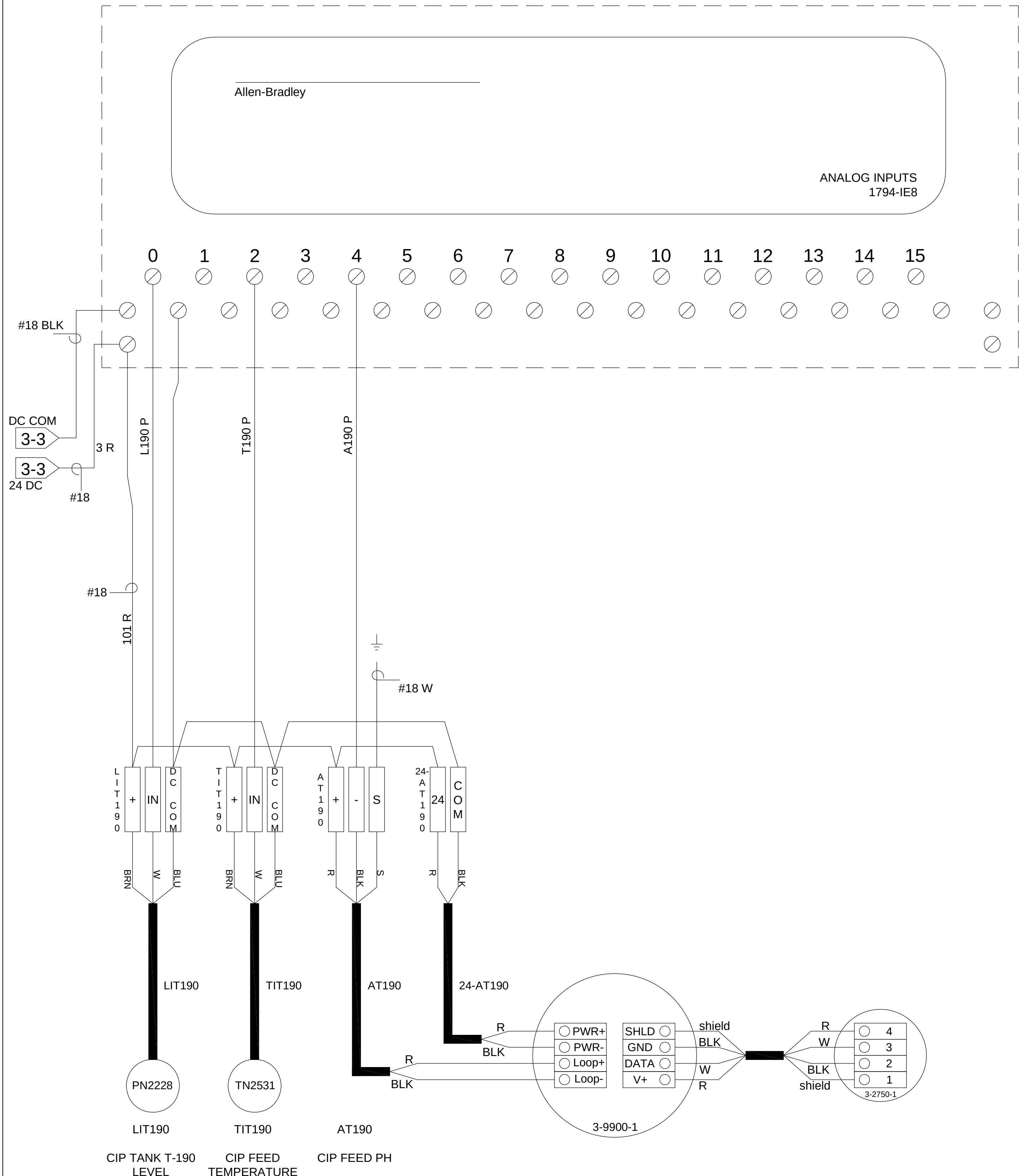
Series i Electrical Schematic
Flex IO - 1DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP SHEET 36 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

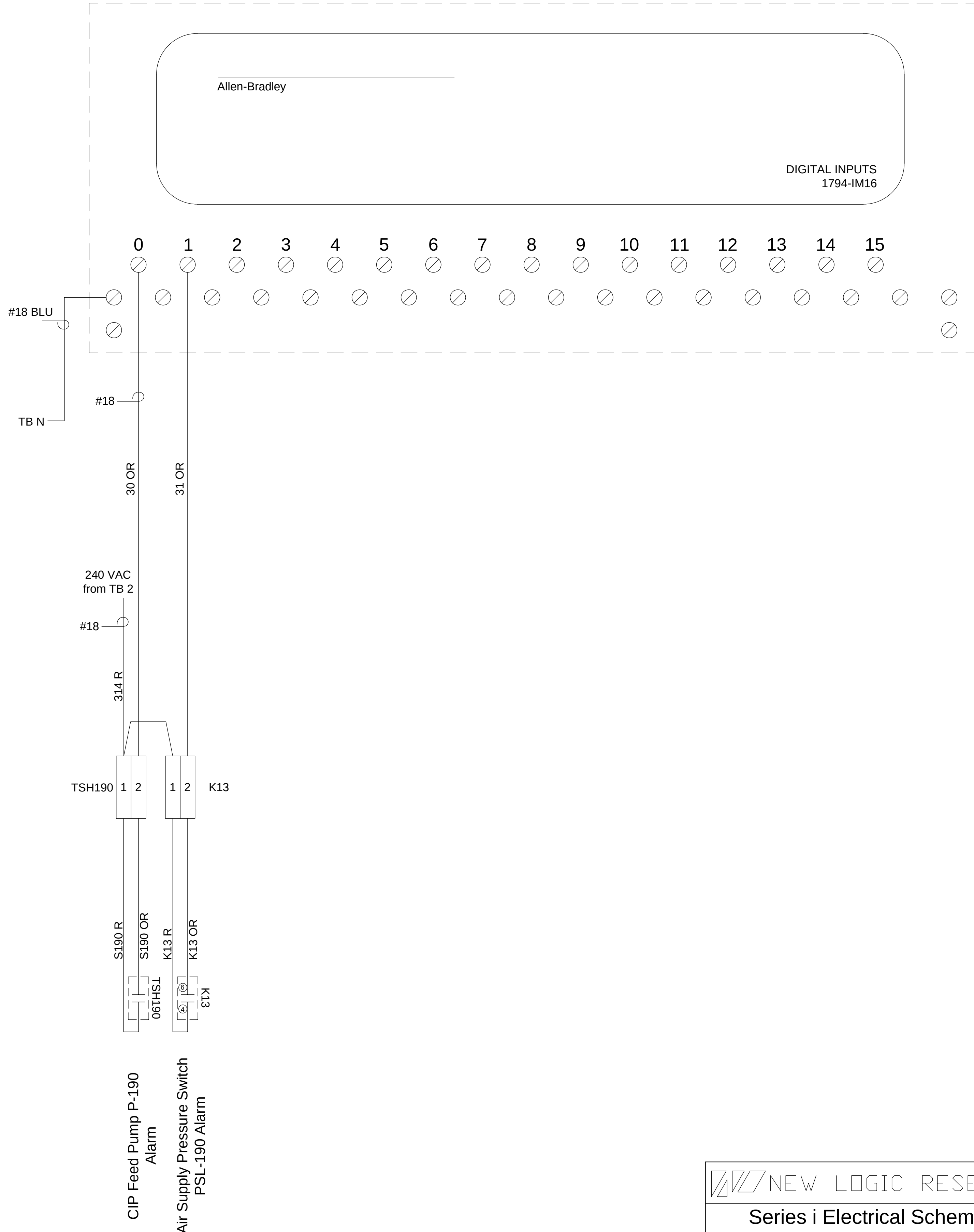
Series i Electrical Schematic
Flex IO - 2AI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP SHEET 37 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 3DI

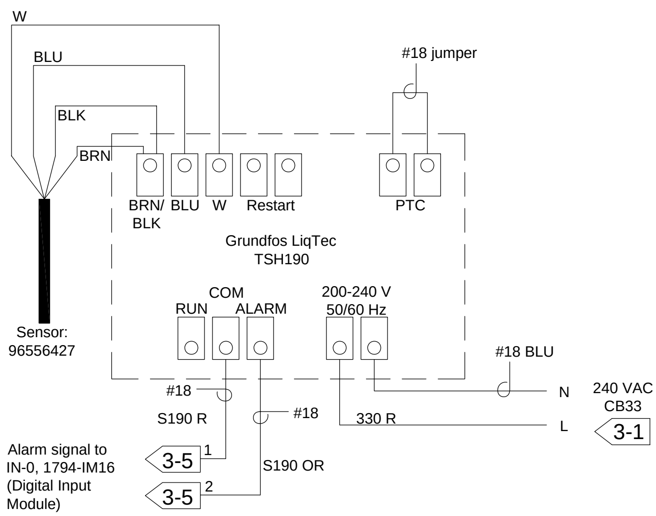
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-5	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP

SHEET 38 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

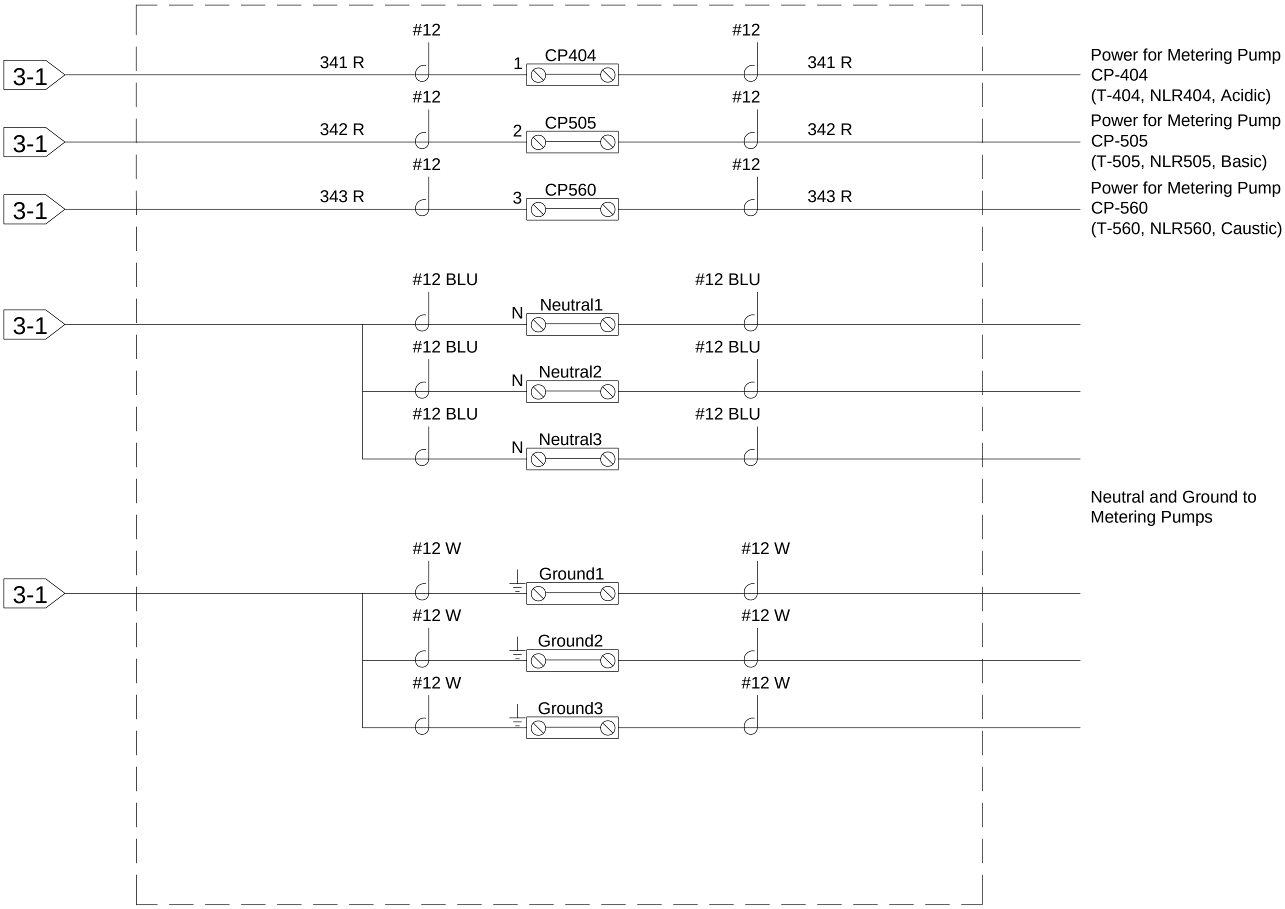
Series i Electrical Schematic
Pump Seal Switch

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-6	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP | SHEET 39 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

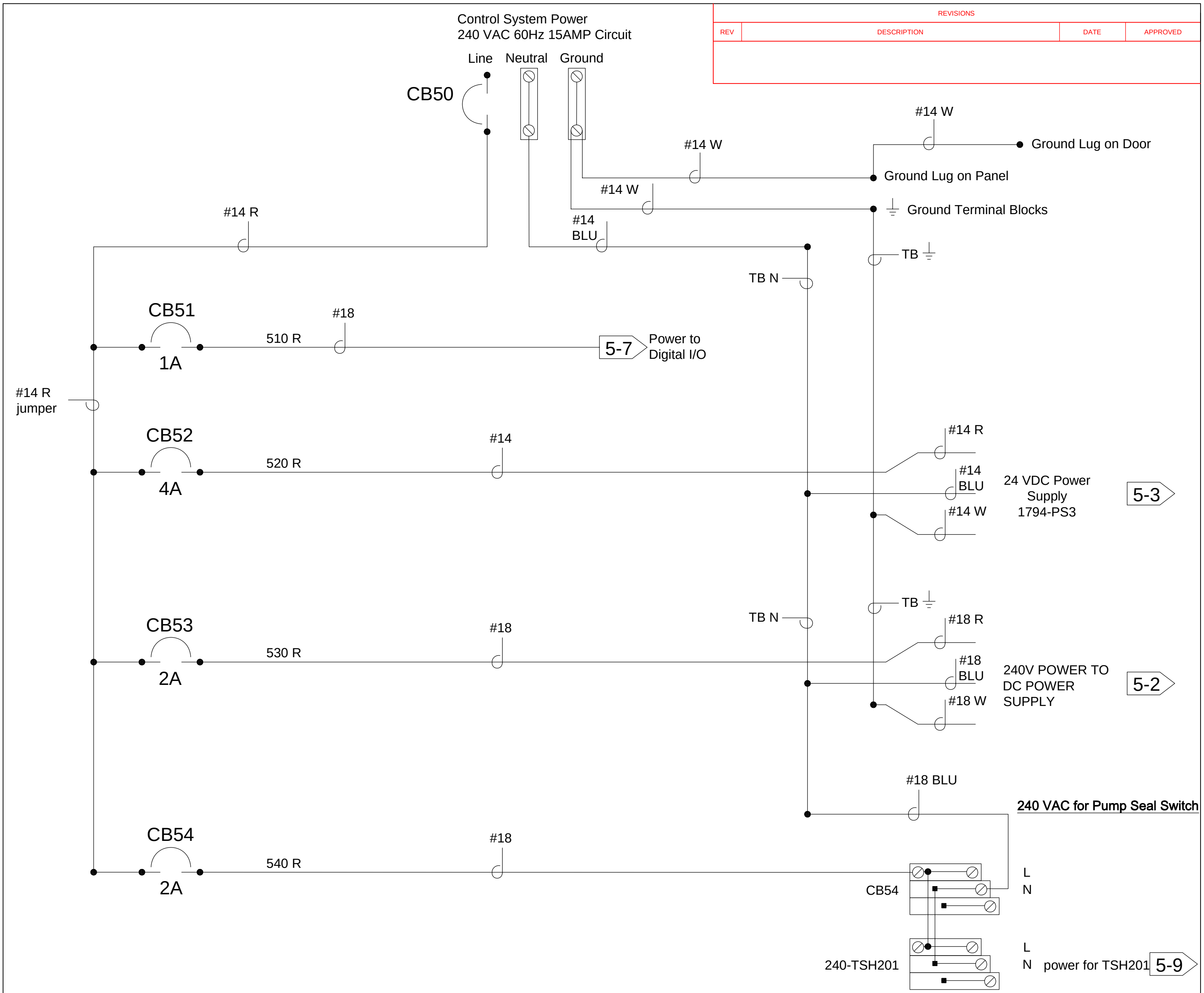
Series i Electrical Schematic
Metering Pump Enclosure

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	4-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CHEM

SHEET 40 of 49



NEW LOGIC RESEARCH

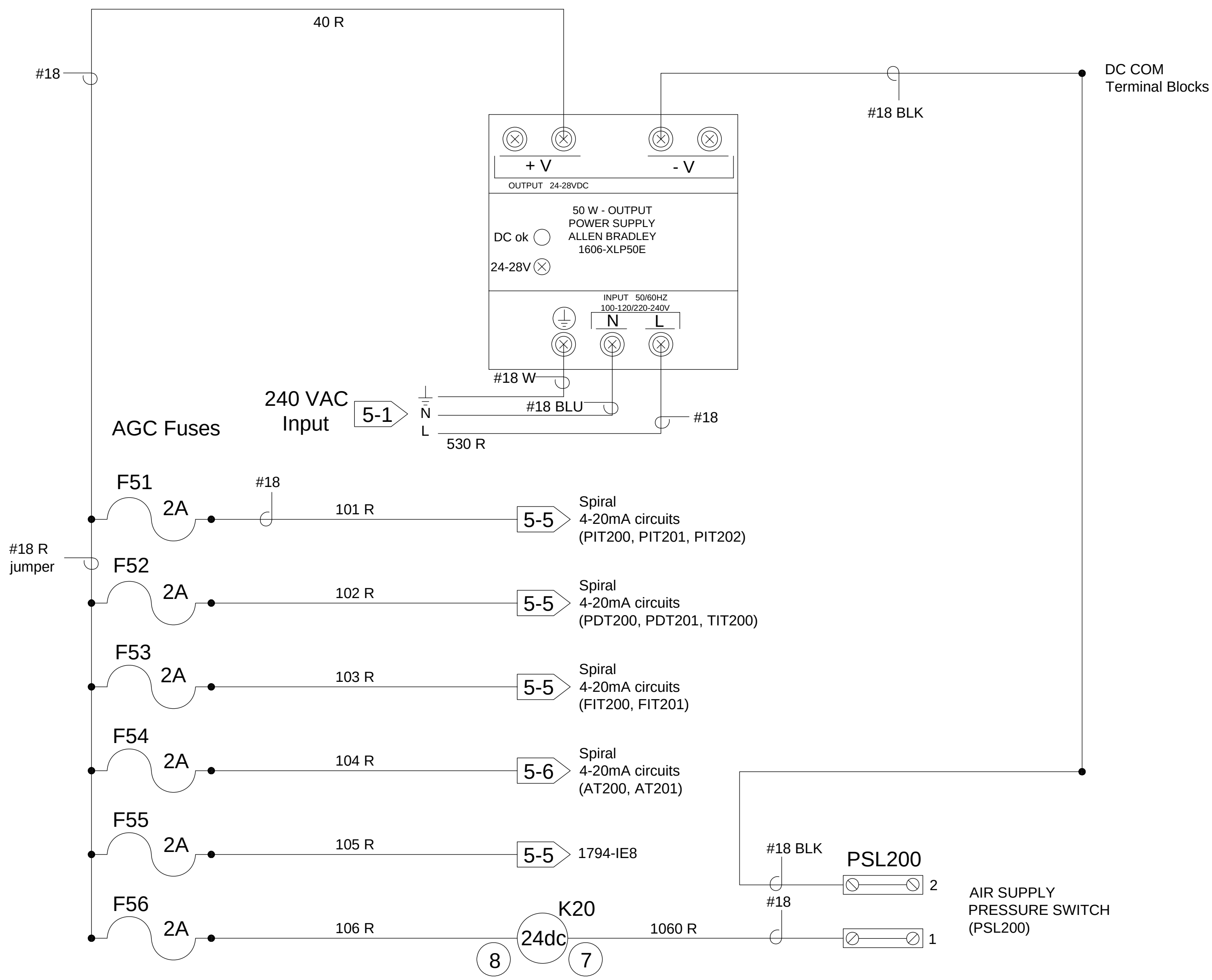
Series i Electrical Schematic
Single Phase

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO
SHEET 41 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

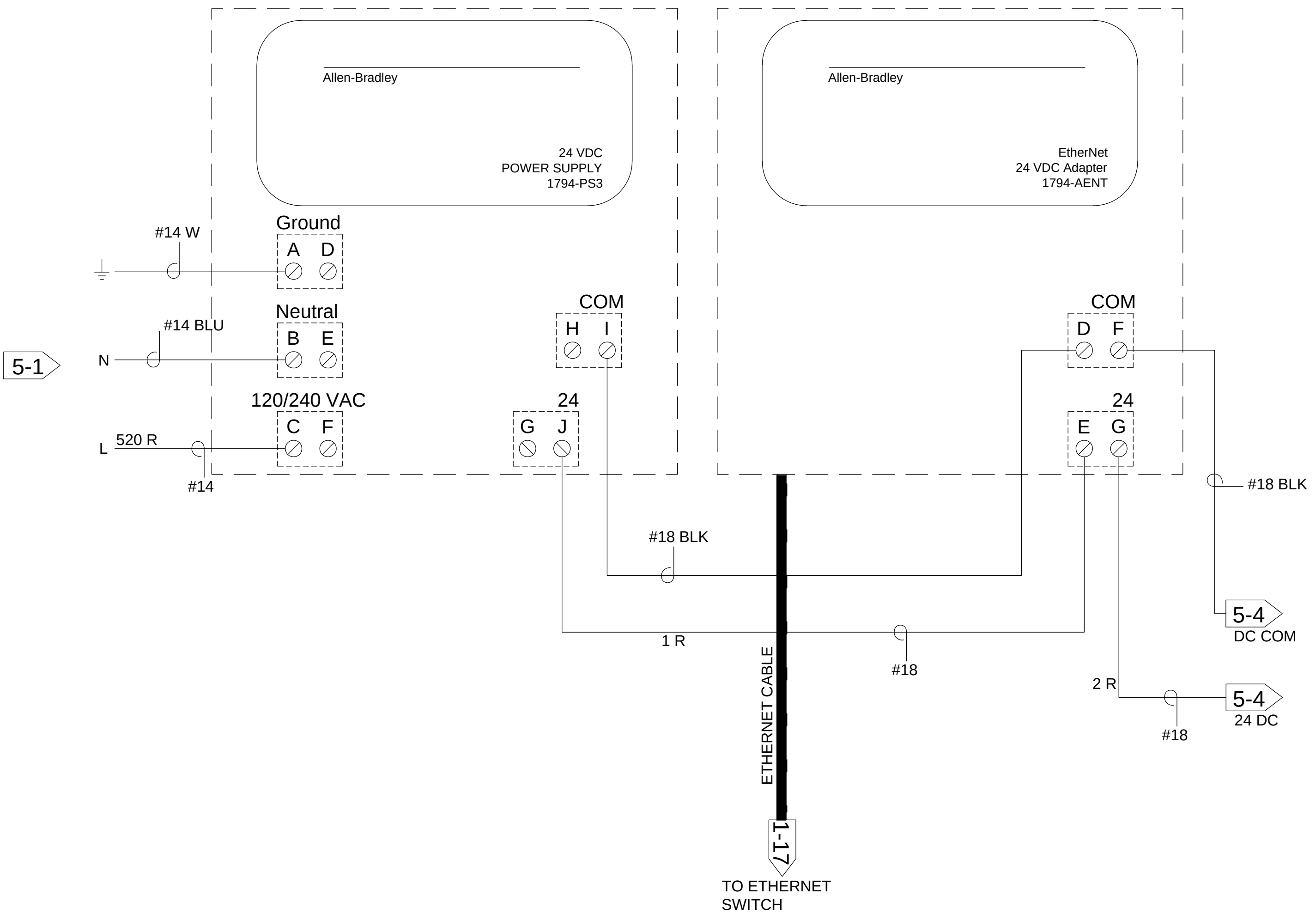
Series i Electrical Schematic
DC

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-2	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO SHEET 42 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO

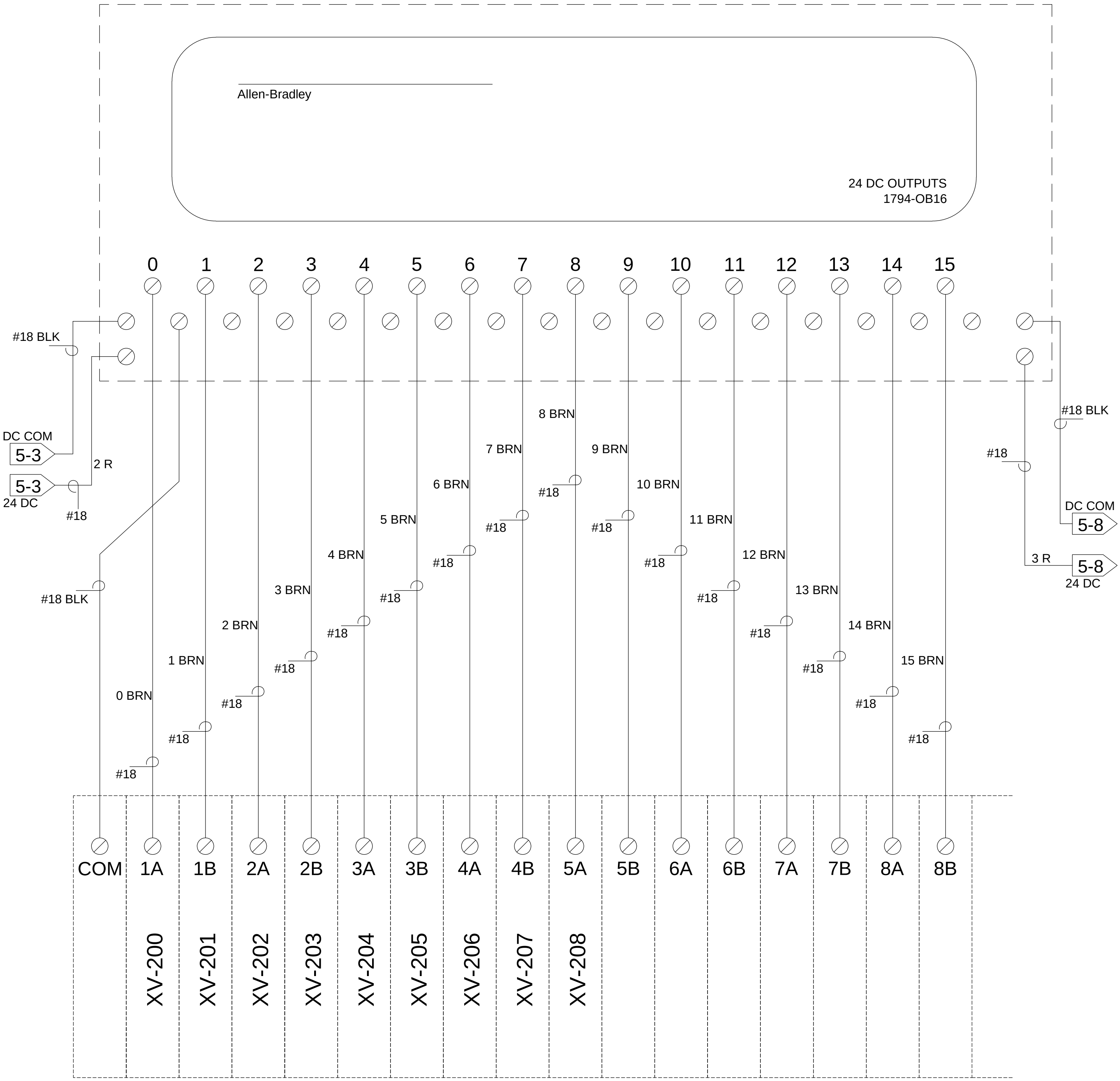
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 43 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Solenoid Valve Rack #1

20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 1DO

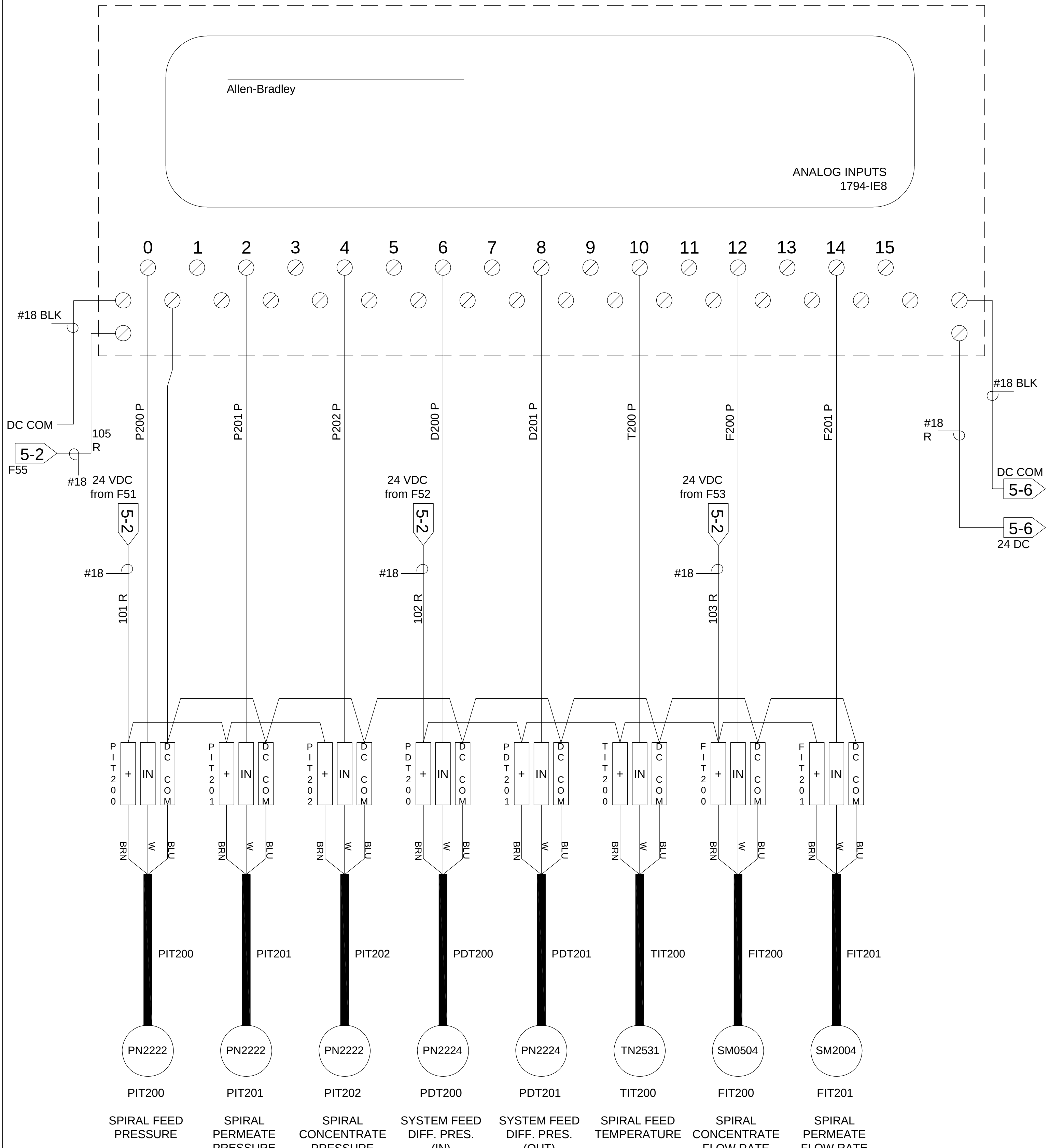
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 44 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

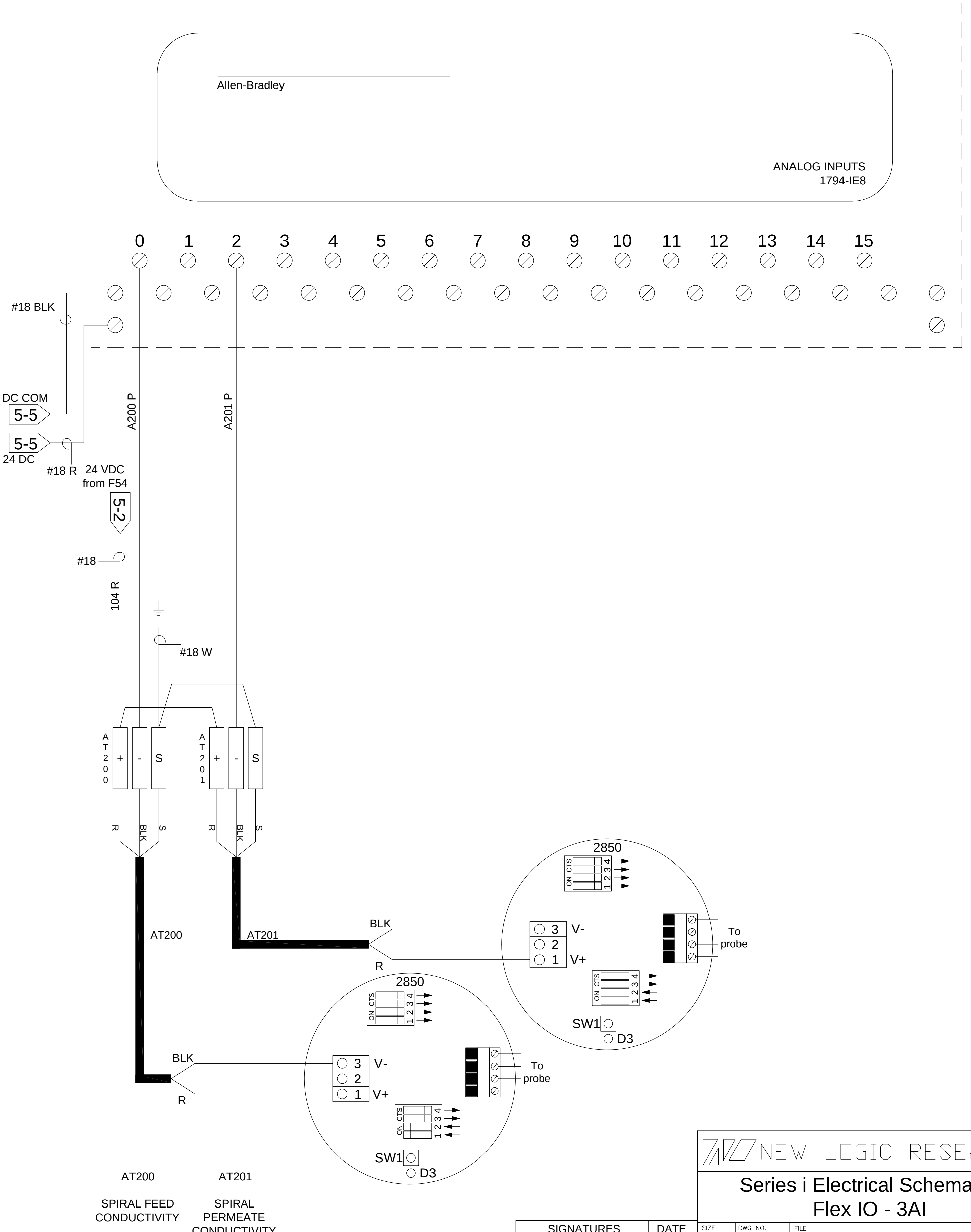
Series i Electrical Schematic
Flex IO - 2AI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-5	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

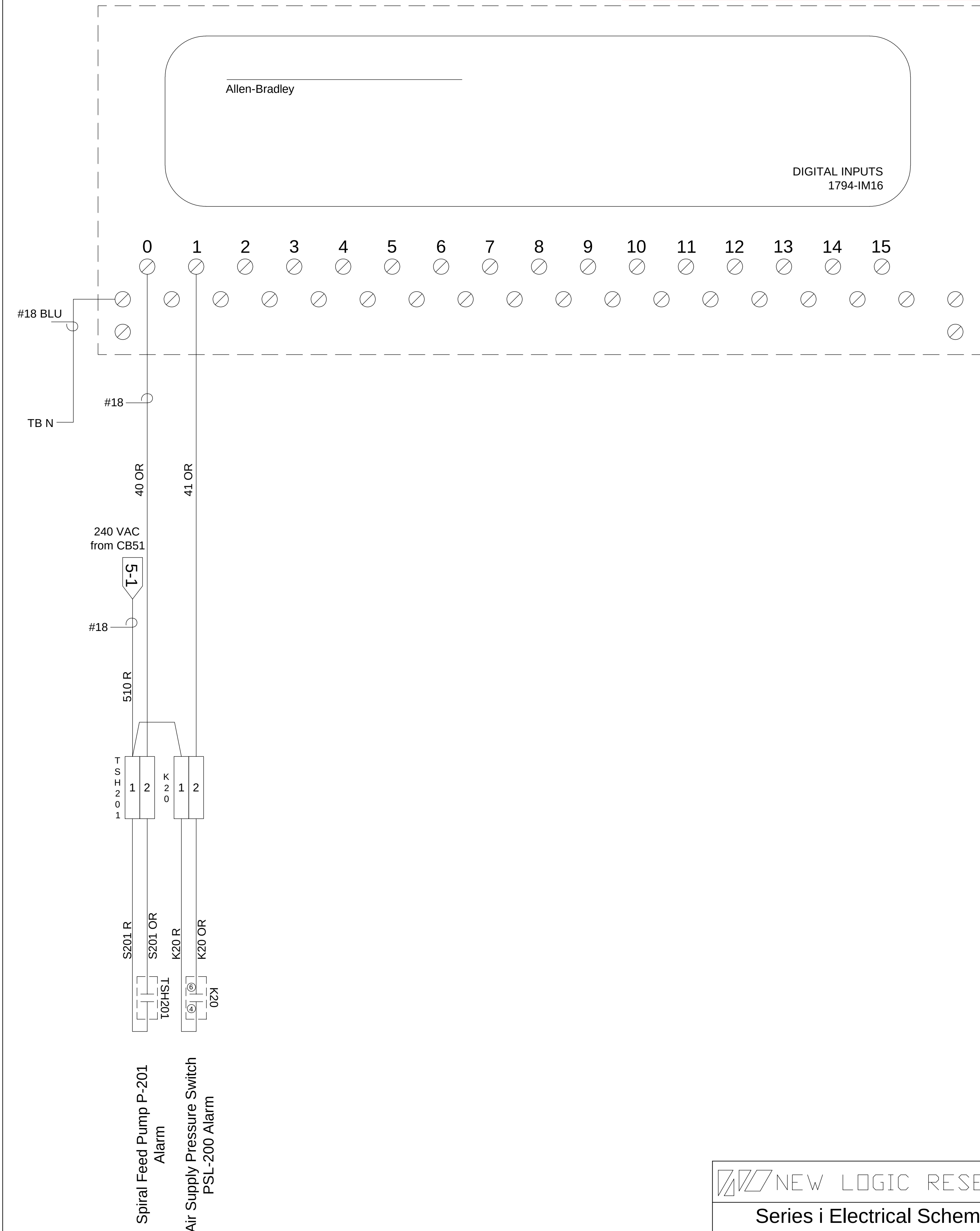
Series i Electrical Schematic
Flex IO - 3AI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-6	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO SHEET 46 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 4DI

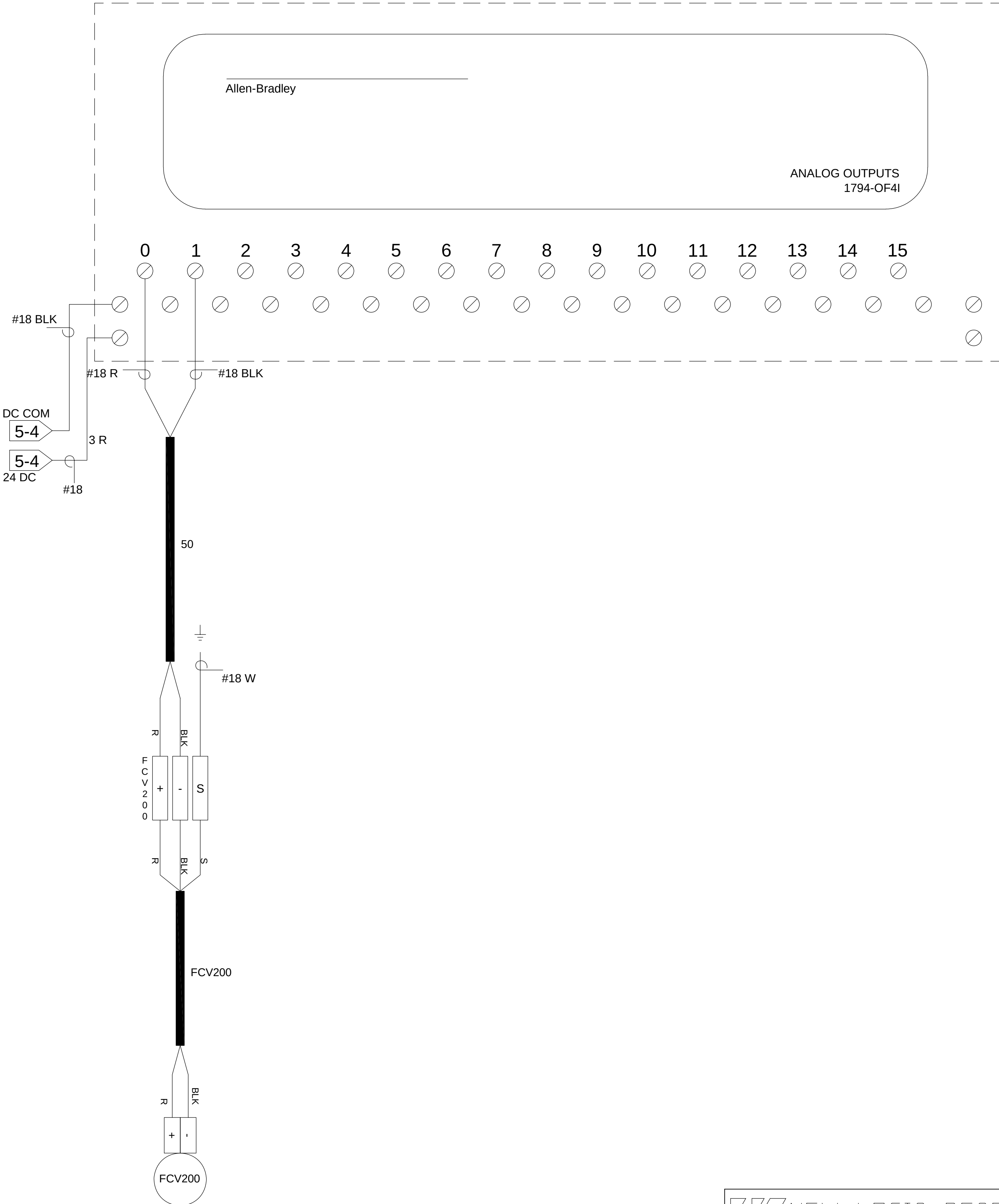
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-7	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 47 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



FCV200

Spiral Concentrate Exit Valve
4-20mA = 0-100%

NEW LOGIC RESEARCH

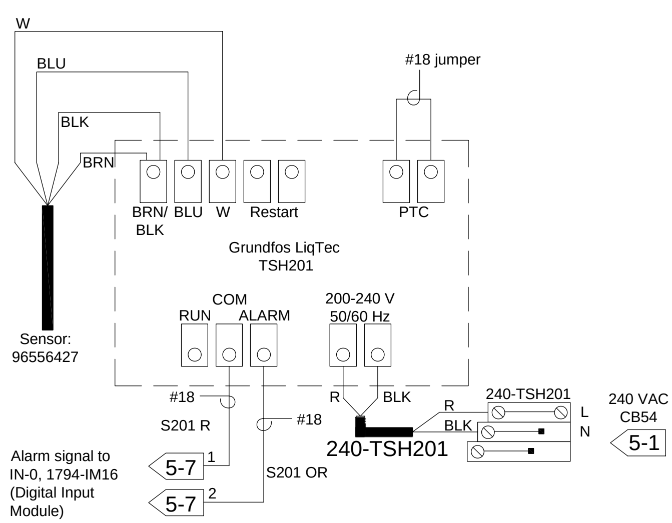
Series i Electrical Schematic
Flex IO - 5AO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-8	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO SHEET 48 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

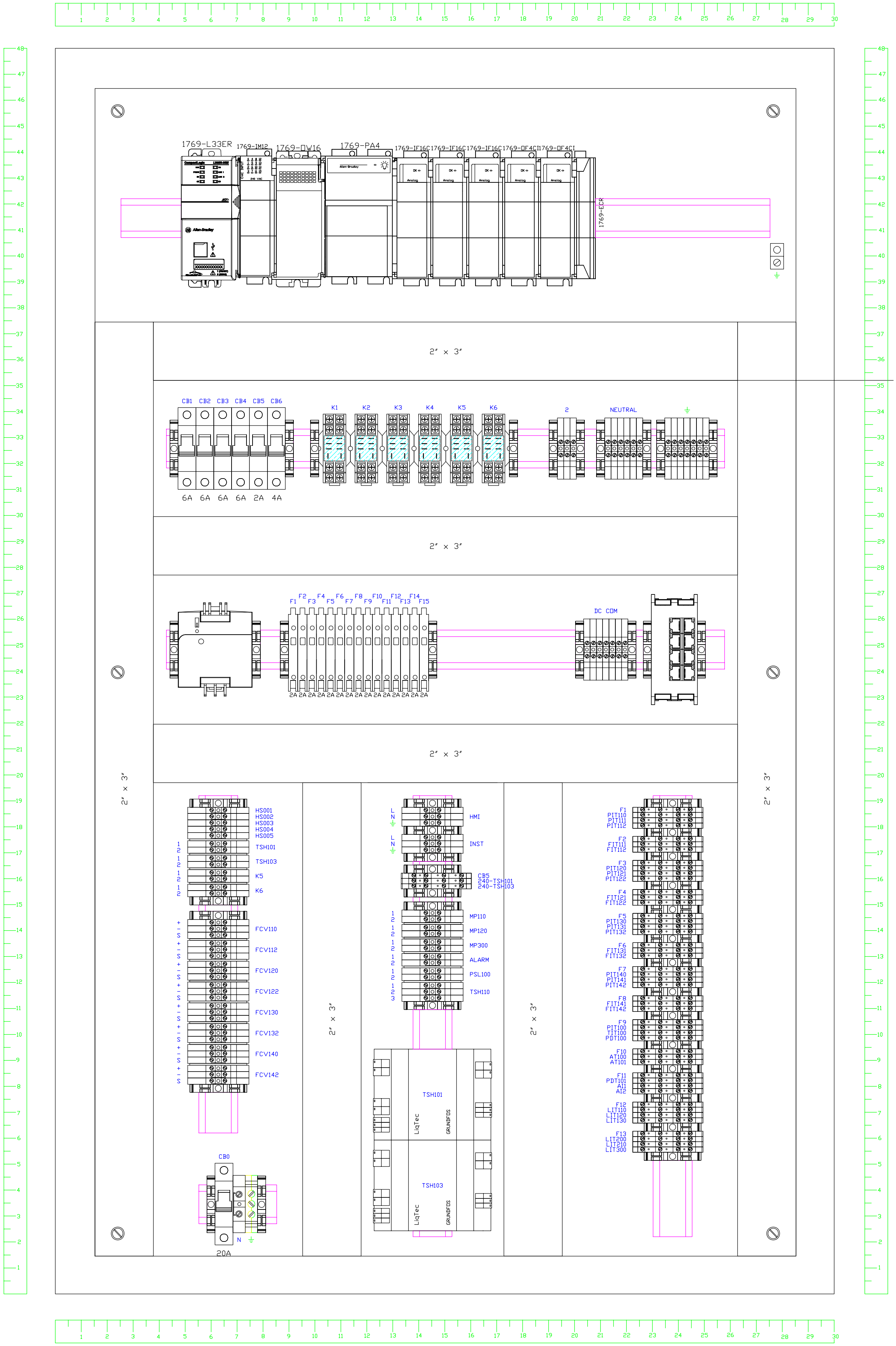


NEW LOGIC RESEARCH

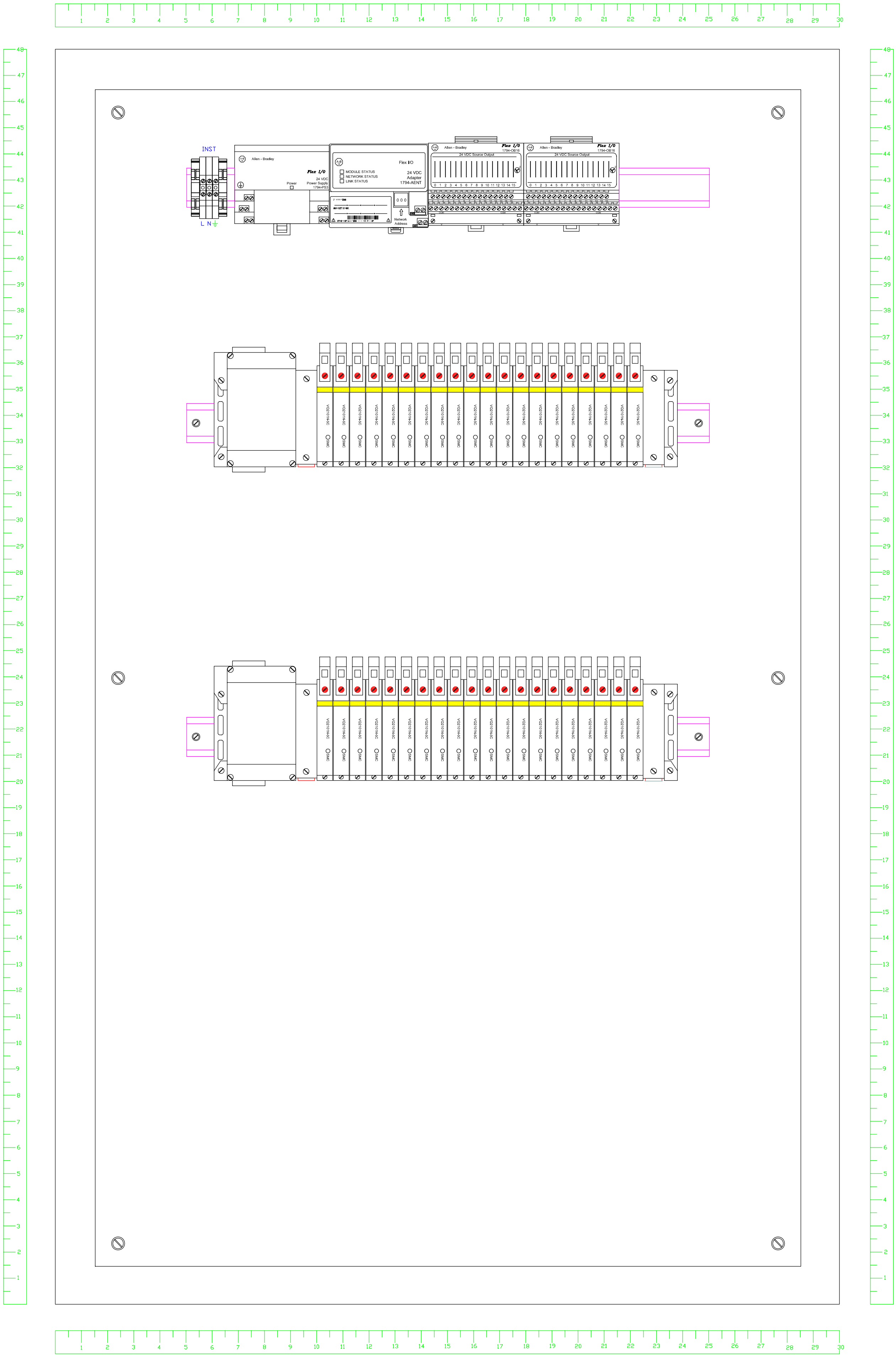
Series i Electrical Schematic
Pump Seal Transmitter

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-9	iEL 4-440-60-ac SDL	
PROJECT:	Santo Domingo Landfill-RO	SHEET	49 of 49



REVISIONS				NEW LOGIC RESEARCH
REV	DESCRIPTION	DATE	APPROVED	SANTO DOMINGO LANDFILL
				MAIN CONTROL ENCLOSURE
				11/22/13 · SDL-MCENCL · REV:



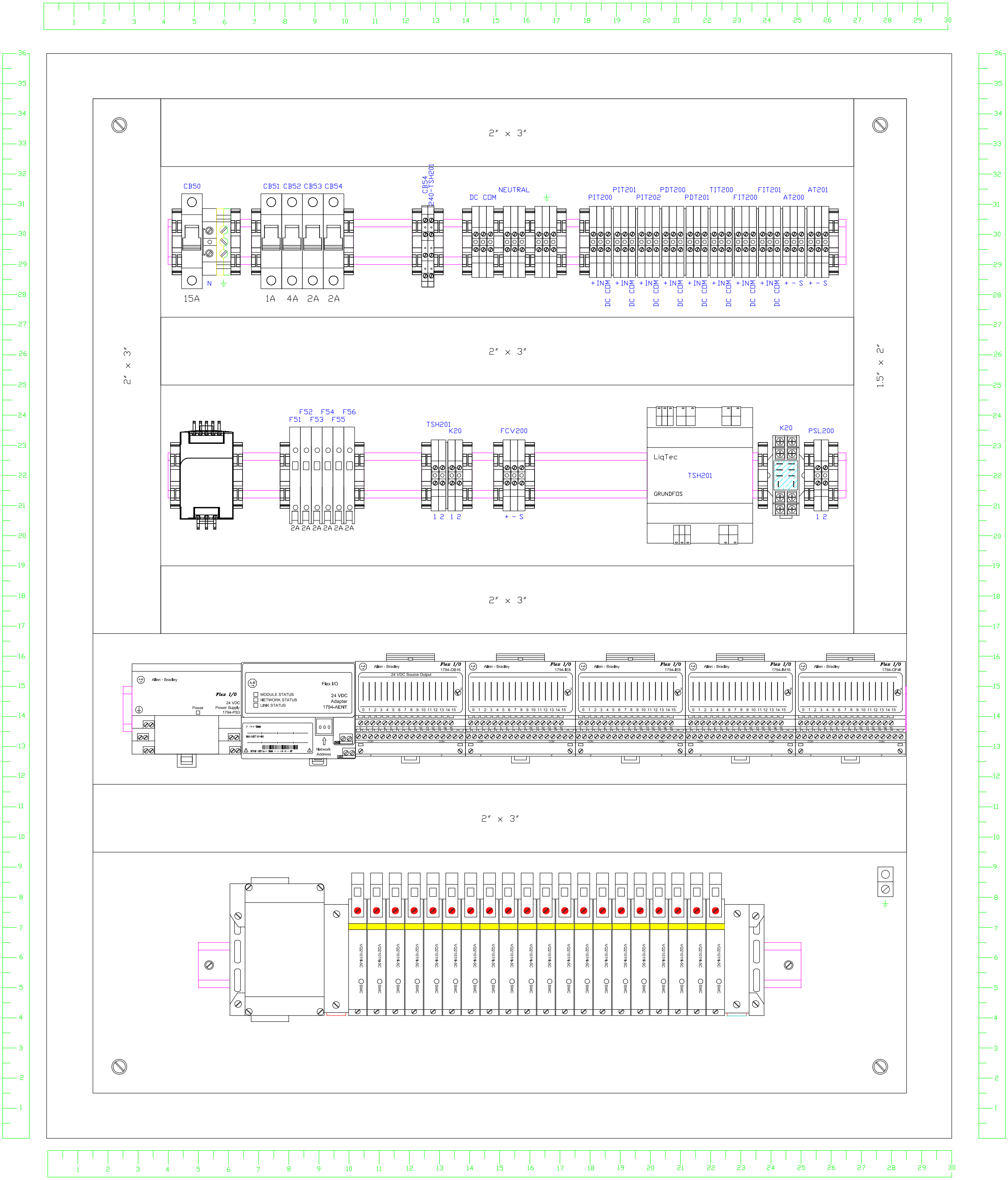
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

VALVE RACK ENCLOSURE

11/22/13	SDL-VRENCL	REV:



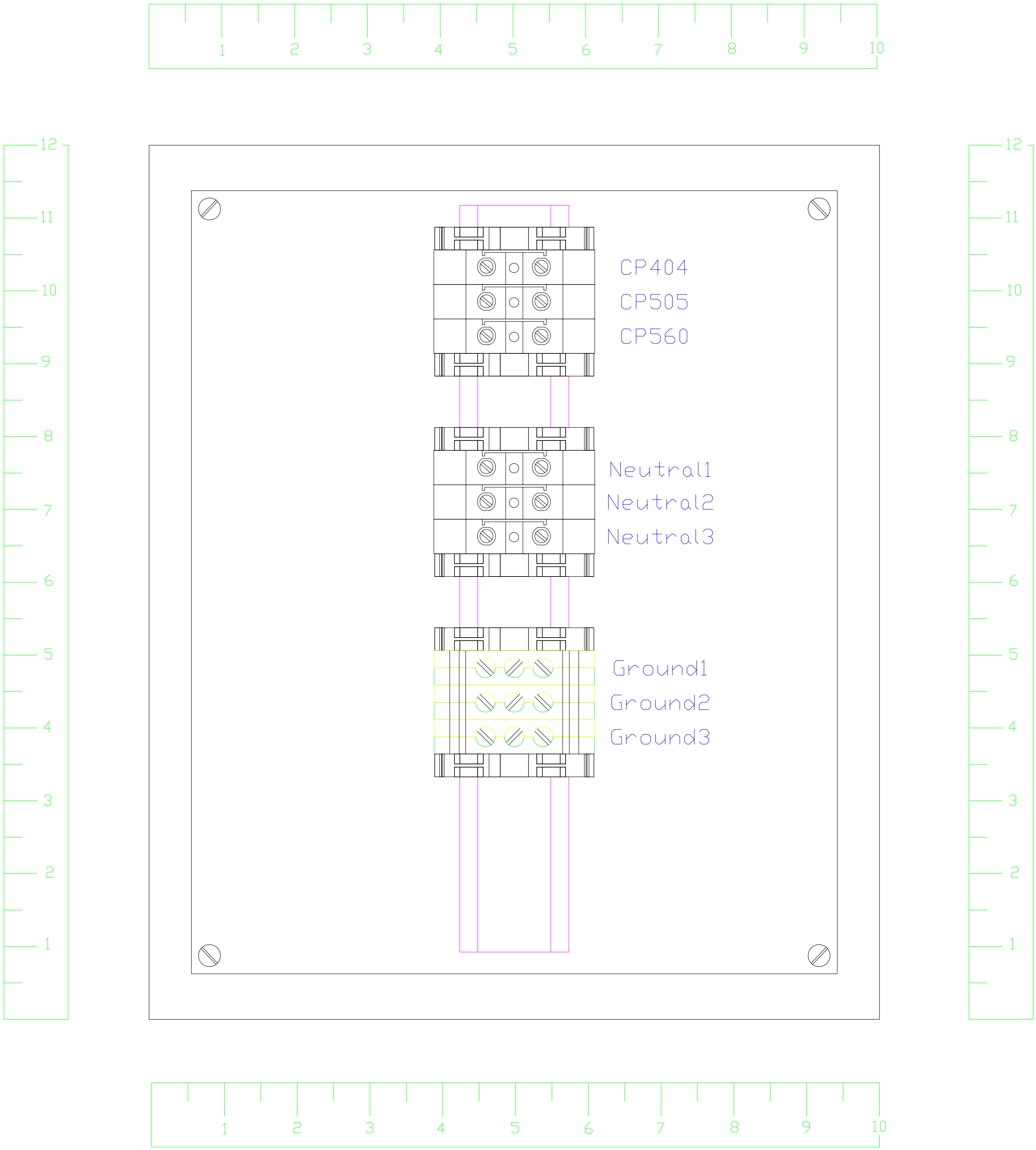
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

RO SPIRAL ENCLOSURE

11/22/13	SDL-ROENCL	REV:



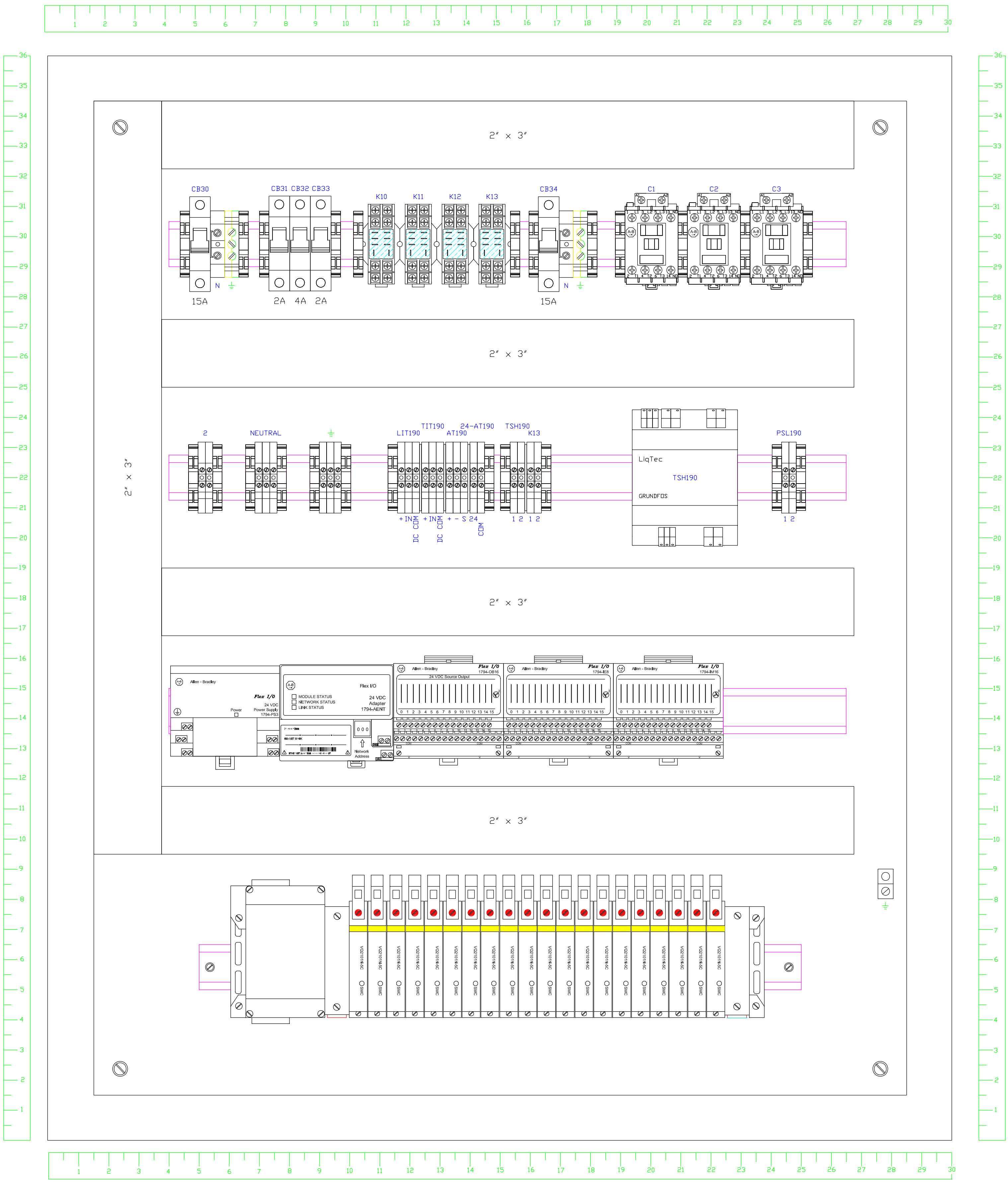
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

METERING PUMP ENCLOSURE

11/22/13	SDL-MPENCL	REV:



REVISIONS

REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

CIP ENCLOSURE

11/22/13 SDL-CIPENCL REV:

DESCRIPTION	QTY.	PART#	MANUFACTURER

Main Enclosure

DESCRIPTION	QTY.	PART#	MANUFACTURER
48"h x 30"w x 10" deep Enclosure	1	A48H30CLP	Hoffman
Enclosure Panel	1	A-48P30	Hoffman
2MB CompactLogix w/ EtherNet	1	1769-L33ER	Allen Bradley
240VAC Digital Input Board	1	1769-IM12	Allen Bradley
Relay Output Board	1	1769-OW16	Allen Bradley
Power Supply	1	1769-PA4	Allen Bradley
16 Single Current Analog Input Board	3	1769-IF16C	Allen Bradley
Analog Output Board	2	1769-OF4CI	Allen Bradley
CompactLogix Right End Cap	1	1769-ECR	Allen Bradley
HMI = 12"TFT, TouchScreen, DUO, 1GB 40G	1	6181P-12TPXP	Allen Bradley
FTViewSE Run Time Package 100 Display	1	9701-VWSB100AENE	Allen Bradley
8 port Unmanaged Ethernet Switch	1	1783-US08T	Allen Bradley
Ethernet Cables (pre made)	2		Comp USA
20 Amp Circuit Breaker	1	1492-SP1B200	Allen Bradley
6 Amp Circuit Breaker	4	1492-SP1B060	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	1	1492-SP1B020	Allen Bradley
DC Power Supply 100W 24VDC	1	1606-XLP100E	Allen Bradley
DC Fuse Blocks	15	1492-H4	Allen Bradley
24VDC Fuses (2A)	15	AGC-2	Buss
Relay (DPDT 24VDC coil)	2	700-HF32Z24	Allen Bradley
Relay (DPDT 240VAC coil)	4	700-HF32A2	Allen Bradley
Relay Socket	6	700-HN116	Allen Bradley
STOP Buttons	2	800H-FRXT6D4	Allen Bradley
STOP Label	2	800T-X550	Allen Bradley
Power Terminal Blocks	1	1492-J16	Allen Bradley
Ground Input Terminal Block	1	1492-JG16	Allen Bradley
Single Terminal Blocks	79	1492-J4	Allen Bradley
Terminal Block End Covers	16	1492-EBJ3	Allen Bradley
Terminal Block Anchors	45	1492-EAJ35	Allen Bradley
3 Wire Sensor Terminal Block	50	1492-WTS3	Allen Bradley
Insertion Bridge for 3 wire term. Blocks	10	1492-SJT5-20-B	Allen Bradley
Terminal Block Jumper Bars with Screws	5	1492-CJJ6-10	Allen Bradley
Terminal Block Markers	1	1492-M6X5	Allen Bradley
2" x 3" Wiring Duct, 6ft	4	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	4	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	5	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	2	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

DESCRIPTION	QTY.	PART#	MANUFACTURER

Wire Gutter

2.5" Feed-Through Type 12 Wireway (60")	2	F22W60	Hoffman
2.5" Feed-Through Type 12 Wireway (36")	2	F22W36	Hoffman
2.5" Feed-Through Type 12 Wireway (12")	2	F22W12	Hoffman
2.5" Telescoping Type 12 Wireway	1	F22WA	Hoffman
2.5" 90° Elbow	3	F22WE90	Hoffman
2.5" Tee	1	F22WT	Hoffman
2.5" Closure Plate	2	F22WP	Hoffman
2.5" Gasket	14	F22WG	Hoffman

DESCRIPTION	QTY.	PART#	MANUFACTURER
Valve Rack Enclosure			
48"h x 30"w x 10" deep Enclosure	1	A48H30CLP	Hoffman
Enclosure Panel	1	A-48P30	Hoffman
24VDC Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	2	1794-OB16	Allen Bradley
Terminal Base for Remote I/O	2	1794-TB2	Allen Bradley
20 Port Solenoid Rack	2	NL-VVC5Q2120/VQC2101	SMC
Single Terminal Blocks	3	1492-J4	Allen Bradley
Terminal Block Anchors	2	1492-EAJ35	Allen Bradley
35mm DIN Rail, 1m=3.28ft	1	199-DR1	Allen Bradley

DESCRIPTION	QTY.	PART#	MANUFACTURER
CIP Enclosure			
36"h x 30"w x 8" deep Enclosure	1	A-36H30BLP	Hoffman
Enclosure Panel	1	A36P30	Hoffman
240VAC 50/60Hz Contactor	3	100-C23KA10	Allen Bradley
Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	1	1794-OB16	Allen Bradley
16 Digital Input Module	1	1794-IM16	Allen Bradley
8 Analog Input Module	1	1794-IE8	Allen Bradley
Terminal Base for remote i/o	3	1794-TB2	Allen Bradley
15 Amp Circuit Breaker	2	1492-SP1B150	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	2	1492-SP1B020	Allen Bradley
Relay (DPDT 24VDC coil)	4	700-HF32Z24	Allen Bradley
Relay Socket	4	700-HN116	Allen Bradley
20 Port Solenoid Rack	1	NL-VVC5Q2120/VQC2101	SMC
Power Terminal Blocks	2	1492-J16	Allen Bradley
Ground Input Terminal Block	2	1492-JG16	Allen Bradley
Single Terminal Blocks	25	1492-J4	Allen Bradley
Terminal Block Anchors	24	1492-EAJ35	Allen Bradley
Terminal Block End Covers	4	1492-EBJ3	Allen Bradley
Terminal Block Jumper Bars with Screws	1	1492-CJJ6-10	Allen Bradley
2" x 3" Wiring Duct, 6ft	2	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	2	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	3	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	1	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

DESCRIPTION	QTY.	PART#	MANUFACTURER
Chemical Metering Enclosure			
Enclosure	1	A1210NF	Hoffman
Enclosure Panel	1	A12P10	Hoffman
Power Terminal Blocks	6	1492-J16	Allen Bradley
Ground Input Terminal Block	3	1492-JG16	Allen Bradley
Terminal Block Anchors	6	1492-EAJ35	Allen Bradley
35mm DIN Rail, 1m=3.28ft	0.5	199-DR1	Allen Bradley

DESCRIPTION	QTY.	PART#	MANUFACTURER
RO Spiral Enclosure			
36"h x 30"w x 8" deep Enclosure	1	A-36H30BLP	Hoffman
Enclosure Panel	1	A36P30	Hoffman
Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	1	1794-OB16	Allen Bradley
16 Digital Input Module	1	1794-IM16	Allen Bradley
4 Analog Output Module	1	1794-OF4I	Allen Bradley
8 Analog Input Module	2	1794-IE8	Allen Bradley
Terminal Base for remote i/o	5	1794-TB2	Allen Bradley
15 Amp Circuit Breaker	1	1492-SP1B150	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	2	1492-SP1B020	Allen Bradley
1 Amp Circuit Breaker	1	1492-SP1B010	Allen Bradley
DC Power Supply 50W 24VDC	1	1606-XLP50E	Allen Bradley
DC Fuse Blocks	6	1492-H4	Allen Bradley
24VDC Fuses (2A)	6	AGC-2	Buss
Relay (DPDT 24VDC coil)	1	700-HF32Z24	Allen Bradley
Relay Socket	1	700-HN116	Allen Bradley
20 Port Solenoid Rack	1	NL-VVC5Q2120/VQC2101	SMC
Power Terminal Blocks	1	1492-J16	Allen Bradley
Ground Input Terminal Block	1	1492-JG16	Allen Bradley
Single Terminal Blocks	48	1492-J4	Allen Bradley
Terminal Block Anchors	23	1492-EAJ35	Allen Bradley
Terminal Block End Covers	10	1492-EBJ3	Allen Bradley
3 Wire Sensor Terminal Block	2	1492-WTS3	Allen Bradley
Terminal Block Jumper Bars with Screws	2	1492-CJJ6-10	Allen Bradley
1.5" x 2" wire duct	0.5	G1.5X2LG6	Panduit
1.5" wire duct cover	0.5	C1.5LG6	Panduit
2" x 3" Wiring Duct, 6ft	2	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	2	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	3	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	1	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

SDL Project - VSEP I/O List

Tag #	Description	I/O Type	Data Type	Units	Range	PLC Source
VSEP#1 Stop	VSEP #1 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch0Data
VSEP#2 Stop	VSEP #2 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch1Data
VSEP#3 Stop	VSEP #3 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch2Data
VSEP#4 Stop	VSEP #4 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch3Data
EMG Stop	Emergency Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch4Data
TSH-101	Booster Pump	DI	BOOL	1=open	0-1	Local:2:I.Ch5Data
TSH-103	Booster Pump	DI	BOOL	1=open	0-1	Local:2:I.Ch6Data
PSL-100	Air Supply Pressure Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch7Data
TSH-110	Transfer Pump P-110 Alarm	DI	BOOL	1=open	0-1	Local:2:I.Ch8Data
	Spare	DI	BOOL			Local:2:I.Ch9Data
	Spare	DI	BOOL			Local:2:I.Ch10Data
	Spare	DI	BOOL			Local:2:I.Ch11Data
	Spare	DI	BOOL			Local:2:I.Ch12Data
	Spare	DI	BOOL			Local:2:I.Ch13Data
	Spare	DI	BOOL			Local:2:I.Ch14Data
	Spare	DI	BOOL			Local:2:I.Ch15Data
PIT-110	VSEP#1 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch0Data
PIT-111	VSEP#1 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch1Data
PIT-112	VSEP#1 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch2Data
FIT-111	VSEP#1 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch3Data
FIT-112	VSEP#1 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch4Data
PIT-120	VSEP#2 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch5Data
PIT-121	VSEP#2 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch6Data
PIT-122	VSEP#2 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch7Data
FIT-121	VSEP#2 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch8Data
FIT-122	VSEP#2 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch9Data
PIT-130	VSEP#3 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch10Data
PIT-131	VSEP#3 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch11Data
PIT-132	VSEP#3 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch12Data
FIT-131	VSEP#3 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch13Data
FIT-132	VSEP#3 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch14Data
	Spare	AI	32 bit REAL			Local:3:I.Ch15Data
PIT-140	VSEP#4 Feed Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch0Data
PIT-141	VSEP#4 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch1Data
PIT-142	VSEP#4 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch2Data
FIT-141	VSEP#4 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:4:I.Ch3Data
FIT-142	VSEP#4 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:4:I.Ch4Data
PIT-100	System Feed Pressure	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch5Data
TIT-100	System Feed Temperature	AI	32 bit REAL	ºC	0-100	Local:4:I.Ch6Data
PDT-100	Feed Differential Pressure IN	AI	32 bit REAL	psi	0-145	Local:4:I.Ch7Data
AT-100	Feed Conductivity	AI	32 bit REAL	µS	0-200000	Local:4:I.Ch8Data
AT-101	VSEP Permeate Conductivity	AI	32 bit REAL	µS	0-10000	Local:4:I.Ch9Data
PDT-101	Feed Differential Pressure OUT	AI	32 bit REAL	psi	0-145	Local:4:I.Ch10Data
LIT-110	VSEP Feed Tank T-110 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch11Data
LIT-120	Concentrate Tank T-120 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch12Data
LIT-130	Permeate Tank T-130 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch13Data
LIT-140	Hot Water Tank T-140 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch14Data
	Spare	AI	32 bit REAL			Local:4:I.Ch15Data
FCV-110	VSEP #1 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch0Data
FCV-112	VSEP #1 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch1Data
FCV-120	VSEP #2 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch2Data
FCV-122	VSEP #2 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch3Data
FCV-130	VSEP #3 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch4Data
FCV-132	VSEP #3 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch5Data
FCV-140	VSEP #4 Feed Inlet	AO	32 bit REAL	%	0-100	Local:7:O.Ch0Data
FCV-142	VSEP #4 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:7:O.Ch1Data
	Spare	AO	32 bit REAL			Local:7:O.Ch2Data
	Spare	AO	32 bit REAL			Local:7:O.Ch3Data
	Spare	AO	32 bit REAL			Local:7:O.Ch4Data
	Spare	AO	32 bit REAL			Local:7:O.Ch5Data

M-P110	Tank T-110 Transfer Pump Motor P-110	DO	BOOL	1=open	0-1	Local:8:O.Ch0Data
M-P120	Concentrate Tank T-120 Transfer Pump Motor	DO	BOOL	1=open	0-1	Local:8:O.Ch1Data
M-P130	Permeate Tank T-130 Transfer Pump Motor	DO	BOOL	1=open	0-1	Local:8:O.Ch2Data
	Alarm	DO	BOOL	1=open	0-1	Local:8:O.Ch3Data
XV-001	Permeate To Hot Water Tank T-140 Valve	DO	BOOL	1=open	0-2	Local:8:O.Ch4Data
XV-002	Permeate to River Valve	DO	BOOL	1=open	0-3	Local:8:O.Ch5Data
	Spare	DO	BOOL			Local:8:O.Ch6Data
	Spare	DO	BOOL			Local:8:O.Ch7Data
	Spare	DO	BOOL			Local:8:O.Ch8Data
	Spare	DO	BOOL			Local:8:O.Ch9Data
	Spare	DO	BOOL			Local:8:O.Ch10Data
	Spare	DO	BOOL			Local:8:O.Ch11Data
	Spare	DO	BOOL			Local:8:O.Ch12Data
	Spare	DO	BOOL			Local:8:O.Ch13Data
	Spare	DO	BOOL			Local:8:O.Ch14Data
	Spare	DO	BOOL			Local:8:O.Ch15Data
XV-100	Hot Water Inlet to Bag Filter	DO	BOOL	1=open	0-1	Enet:1:O. Data.0
XV-101	Feed Inlet to Bag Filter	DO	BOOL	1=open	0-1	Enet:1:O. Data.1
XV-102	Feed to Header	DO	BOOL	1=open	0-1	Enet:1:O. Data.2
XV-103	Feed to Header	DO	BOOL	1=open	0-1	Enet:1:O. Data.3
XV-105	Permeate to VSEP Feed Tank, T-110	DO	BOOL	1=open	0-1	Enet:1:O. Data.4
XV-106	Permeate to Holding Tank, T-130	DO	BOOL	1=open	0-1	Enet:1:O. Data.5
XV-107	Concentrate to VSEP Feed Tank, T-110	DO	BOOL	1=open	0-1	Enet:1:O. Data.6
XV-108	Concentrate to Reject Tank, T-120	DO	BOOL	1=open	0-1	Enet:1:O. Data.7
XV-110	CIP Feed to VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.8
XV-111	CIP Permeate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.9
XV-112	Permeate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.10
XV-113	CIP Concentrate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.11
XV-114	Concentrate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.12
XV-120	CIP Feed to VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.13
XV-121	CIP Permeate From VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.14
XV-122	Permeate From VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.15
XV-123	CIP Concentrate From VSEP #2	DO	BOOL	1=open	0-1	Enet:2:O. Data.0
XV-124	Concentrate From VSEP #2	DO	BOOL	1=open	0-1	Enet:2:O. Data.1
XV-130	CIP Feed to VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.2
XV-131	CIP Permeate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.3
XV-132	Permeate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.4
XV-133	CIP Concentrate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.5
XV-134	Concentrate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.6
XV-140	CIP Feed to VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.7
XV-141	CIP Permeate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.8
XV-142	Permeate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.9
XV-143	CIP Concentrate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.10
XV-144	Concentrate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.11
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.12
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.13
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.14
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.15
XV-190	Hot Water to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.0
XV-191	Hot Water to VSEP	DO	BOOL	1=open	0-1	Enet:3:O. Data.1
XV-192	CIP Tank to Drain	DO	BOOL	1=open	0-1	Enet:3:O. Data.2
XV-193	CIP Tank to Pump	DO	BOOL	1=open	0-1	Enet:3:O. Data.3
XV-194	CIP Pump to Feed Header	DO	BOOL	1=open	0-1	Enet:3:O. Data.4
XV-195	Feed Bypass to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.5
XV-196	Permeate to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.6
XV-197	Permeate to Destination	DO	BOOL	1=open	0-1	Enet:3:O. Data.7
XV-198	Concentrate to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.8
XV-199	Concentrate to Destination	DO	BOOL	1=open	0-1	Enet:3:O. Data.9
	Spare	DO	BOOL			Enet:3:O. Data.10
	Spare	DO	BOOL			Enet:3:O. Data.11
	Spare	DO	BOOL			Enet:3:O. Data.12
CP-404	Run Chemical Pump CP-404	DO	BOOL	1=open	0-1	Enet:3:O. Data.13
CP-505	Run Chemical Pump CP-505	DO	BOOL	1=open	0-1	Enet:3:O. Data.14
CP-560	Run Chemical Pump CP-560	DO	BOOL	1=open	0-1	Enet:3:O. Data.15

LIT-190	VSEP CIP Tank, T-190 Level	AI	32 bit REAL	%	0-100	Enet:4:I. Data.0
	Spare	AI	32 bit REAL			Enet:4:I. Data.1
TIT-190	CIP Feed Temperature	AI	32 bit REAL	°C	0-100	Enet:4:I. Data.2
	Spare	AI	32 bit REAL			Enet:4:I. Data.3
AT-190	CIP Feed pH	AI	32 bit REAL	pH	0-14	Enet:4:I. Data.4
	Spare	AI	32 bit REAL			Enet:4:I. Data.5
	Spare	AI	32 bit REAL			Enet:4:I. Data.6
	Spare	AI	32 bit REAL			Enet:4:I. Data.7
	Spare	AI	32 bit REAL			Enet:4:I. Data.8
	Spare	AI	32 bit REAL			Enet:4:I. Data.9
	Spare	AI	32 bit REAL			Enet:4:I. Data.10
	Spare	AI	32 bit REAL			Enet:4:I. Data.11
	Spare	AI	32 bit REAL			Enet:4:I. Data.12
	Spare	AI	32 bit REAL			Enet:4:I. Data.13
	Spare	AI	32 bit REAL			Enet:4:I. Data.14
	Spare	AI	32 bit REAL			Enet:4:I. Data.15
TSH-190	CIP Feed Pump P-190 Alarm	DI	BOOL	1=open	0-1	Enet:5:I. Data.0
PSL-190	Air Supply Pressure Switch	DI	BOOL	1=open	0-1	Enet:5:I. Data.1
	Spare	DI	BOOL			Enet:5:I. Data.2
	Spare	DI	BOOL			Enet:5:I. Data.3
	Spare	DI	BOOL			Enet:5:I. Data.4
	Spare	DI	BOOL			Enet:5:I. Data.5
	Spare	DI	BOOL			Enet:5:I. Data.6
	Spare	DI	BOOL			Enet:5:I. Data.7
	Spare	DI	BOOL			Enet:5:I. Data.8
	Spare	DI	BOOL			Enet:5:I. Data.9
	Spare	DI	BOOL			Enet:5:I. Data.10
	Spare	DI	BOOL			Enet:5:I. Data.11
	Spare	DI	BOOL			Enet:5:I. Data.12
	Spare	DI	BOOL			Enet:5:I. Data.13
	Spare	DI	BOOL			Enet:5:I. Data.14
	Spare	DI	BOOL			Enet:5:I. Data.15
	Spare	DO	BOOL			Enet:6:O. Data.9
	Spare	DO	BOOL			Enet:6:O. Data.10
	Spare	DO	BOOL			Enet:6:O. Data.11
	Spare	DO	BOOL			Enet:6:O. Data.12
	Spare	DO	BOOL			Enet:6:O. Data.13
	Spare	DO	BOOL			Enet:6:O. Data.14
	Spare	DO	BOOL			Enet:6:O. Data.15

5.1 VSEP Control Strategy

Customer: SDL Santo Domingo Landfill
Location: Santo Domingo de los Tsachilas, Quito, Ecuador
Feed Material: Landfill Leachate
Membrane: ESPA & LFC3-LD

5.1.1] Process Description:

Santo Domingo Landfill has several leachate ponds. The waste from Santo Domnigo City and surrounding towns is collected and sent to this landfill. They have reached the maximum capacity of these ponds and have reached a point where they need to treat this leachate to reduce the levels in the pond and make some space for future leachate storage.

The leachate will be pre-screened and then will be sent for a first pass through VSEP ESPA System. Permeate generated from VSEP system will be further processed through 2nd stage Spiral RO system, to ensure good quality. The concentrate from both, first and second stage will be sent back to the leachate ponds.

Process feed conditions:

Process Flow Rate	166-333 m3/day
Process Temperature:	Ambient
Process Pressure:	450 psi (500 max)
Operating Method:	Single Pass – Constant Flow

First stage will comprise of a four unit expandable VSEP system with an initial one 84" ESPA VSEP modules (1400SF each). The second stage will comprise of six 40”x8” LFC-3LD (1200SF per module) RO Spiral modules.

The system will come with many options for control methods and will be fitted with a local control that can communicate with the main plant logic system. The system will include a PLC and will be run locally. The VSEP and Spiral systems will include the membrane modules, the control and pumping skid with integral CIP functions, and a chemical metering pump station for delivery of NLR cleaners for automated cleaning functions.

5.1.2] Filtration Overview:

All feed material must be pre-screened before being processed through the VSEP unit. During each filtration mode, the system will data log appropriate information such as, temperature, pressure, flow rates etc.

The program will consist of two filtration methods as described below. The process will continue until the system is prompted to shut down for an alarm or for flushing/cleaning. These prompts include feed and destination tank levels, permeate flux reaches lowest acceptable level or permeate quality reaches the highest acceptable level. Timed quick hot water flushes could be used intermittently during processing to increase time between full chemical cleanings.

1. **Single Pass – Constant Flow:** For this project, the goal is to generate high volumes of permeate and reduce the levels in the ponds rather than achieving an *immediate* high % recovery. For this purpose it is recommended to run the system in Single Pass – Constant Flow mode. Here the feed material is processed through the VSEP system and permeate and concentrate are sent to their appropriate destinations. Notice that the concentrate will be sent back to the leachate ponds and not back to the VSEP batch feed tank. So in theory the ponds are viewed as large batch feed tanks which will get concentrated over longer periods of time. This means that the feed material will always remain consistent and thus will allow having good stable permeate flow rates as well as good quality. The frequency of full chemical cleaning cycle will be reduced compared to other filtration methods.

   With Batch filtration, the feed material will become concentrated towards the end of the batch, since the concentrate stream is recycled back to the batch feed tank. Thus the feed exposed to the membranes towards the end of the batch will consist of high TSD/TSS level. This will affect the performance in terms of flux. A decline in flux is noticed as the batch progresses and hence the flux rate will not be consistent throughout the whole batch.

2. **Batch Concentration:** For Batch Concentration the system will start with a full tank and remove up to ~75% (in accordance with desired recovery) of the volume of the tank as permeate while sending the VSEP concentrate back to the feed tank. Once the feed tank has had ~75% or more of the volume removed, the concentrate will be diverted to its destination tank, T-120, until the feed tank is empty. Then the VSEP system will flush via Hot Water In line from VSEP feed pump skid (automated function) while the feed tank, T-110 is being refilled simultaneously. It is possible to have two batch feed tanks so that when one feed tank is being processed, the second tank will be refilled simultaneously and sit in standby mode once filled. This will allow for minimum downtime.

   Since the feed to the VSEP will vary greatly with different beginning % solids levels, the concentration level achieved will also need to vary. The system would be run at a recovery value that yields optimum concentration and filtrate that is of an equivalent quality. This optimum concentration level would represent the maximum optimum concentration that the VSEP can produce clean filtrate reliably and at a good throughput rate. Maximum volume reduction is desired, however, there is a converse relationship between concentration level and permeate quality. If the concentration level goes too high, permeate quality may begin to worsen due to the set rejection of the membrane. While controlling the VSEP system, we will need to control the % volume reduction as well as the permeate quality and both will be monitored and used for determining the ending concentration level. Permeate quality may be monitored by conductivity readings and volume reduction may be monitored by percent recovery.

5.1.3] Filtration Set Points:

Configurable set points included are:

i) Feed Pressure_– The VSEP will be run at constant pressure, which will mean that the pressure through the VSEP will be held constant. At all times during filtration, the feed pump will adjust by means of a VFD to hold a specific pressure.

ii) Concentrate Flow – A specified % recovery is required across VSEP in order to achieve the end result desired. In addition, a minimum amount of fluid velocity is required in each filter pack to prevent “Dead Zones”, “Cake Formation”, “Gel Pockets”, and other feed material inconsistencies which can affect flux and also potentially cause plugging of the filter pack. These two controlling parameters are in conflict if the % recovery demand is so high that the concentrate flow rate would fall below the minimum safe rate. For most filter packs this minimum safe number is ~ 2 GPM, (~7.5L/min) per tray within the last section of trays in the filter pack.

iii) Start/Stop Control – starting from the Local Control Panel; if the system is ready, the operator may start the system by using the green START button at the local control panel. For the system to be ready, the following conditions must be met.

- The system must be set for Filtration Mode
- The latching STOP button must be released or pulled out
- The system must not be stopped by an alarm
- The Feed Tank must be more than 10% full
- Destination tanks 90% or less full.
-

iv) Vibration Amplitude – Before VSEP vibration can be started, the minimum safe operating pressure must be achieved. The reason for this is that pressure holding the membrane pressed against the steel tray which supports it is required to counteract the effects of side to side movement during vibration. Without sufficient pressure holding the membrane down, it could shred or come apart as it is tugged from side to side. It is this unique relationship between pressure and vibration, which is the key to the VSEP technology. The key pressure, which is calculated, is the "Trans-Membrane" pressure, which is calculated by subtracting the permeate pressure from the concentrate pressure. This value should be at least 35 psi (241 kPa). The feed and concentrate pressure must also meet a minimum of 40 psi (276 kPa). Lastly a set point for a percentage of total VFD speed is able to be manipulated to adjust the amplitude of vibration. This number can vary between feed materials, filter packs, and VSEP frames; but is usually in the range of 20-30%.

v) Tank Level Control – The VSEP system will be configured to run continuously and it will assume that the proper feed has been delivered to the VSEP feed tank. The VSEP will monitor the feed tank level and run after getting a start command based on a configurable tank level set point. The program will include an interlock, so that, the system cannot be started with an empty tank. For the purposes of design, the tank level must read greater than 5%. If the system starts up on a nearly dry tank, the feed pumps will spin up to try to reach the pressure setpoint. If it is unable to do so within a timed interval, the system will shut down on alarm and would self-initiate an ALARM FLUSH after a brief pause for operator intervention. This flush will be done for a timed interval using hot water via the hot water inlet to the feed pump.

The display will flash a warning when the tank level is 5% about the low-level set point. This warning will allow the operator to intervene. Once the tank level reaches low level, the system will flush with hot water through the feed pump with pressure and vibration without stopping. This low tank level set point will be configurable and should be high enough to prevent cavitation of the feed pump.

vi) Auto-Fill VSEP Batch Feed Tank – There will be one EQ Tank, T-100 and one VSEP Batch Feed Tank, T-110. Both will have Level Transmitters, which will be hardwired to VSEP PLC. There will be "dead band" ranges for T-110 which will allow for this auto-fill function. These dead band configurable set points will be: *full tank level, stop tank level.* A transfer pump will be between the two tanks which will allow to transfer material from T-100 to T-110. At the beginning of the process the level in VSEP Batch Feed Tank, T-110 will be empty which will be read by VSEP PLC. Upon reading this 0% (empty tank level), the VSEP PLC will turn on P-110 and will start to transfer material from T-100 into T-110. Once the tank level reaches a configurable *full tank level* set point the transfer pump will stop and the VSEP system will start to process feed material from this tank. Once the tank reaches *stop tank level*, there will be a 5min hot water flush and simultaneously P-110 will turn on to transfer material from T-100 to T-110. The filtration will commence again once appropriate tank level has been reached.

5.1.4] Filtration Automation:

Automation includes:

i. Feed Pressure PID – The control system will monitor the feed pressure as a single input and the feed pump will hunt to hold the specified pressure setpoint. Other pressure readings such as concentrate and trans-membrane pressure may vary during operation, but the feed pump will hold feed pressure constant. The pressure set point will be configurable.

ii. Concentrate Flow PID – The control of the Concentrate Valve will be done using a Flow Control PID loop with a subroutine for cycling of the valve. The control variable for the PID loop is the flow measurement from the concentrate flow meter. The process variable is the concentrate valve position. (0-100% Open) The operating flow set point of 20 GPM (dependant on filter pack design) is entered on the Filtration Mode Set point's screen. When the pump is started, the valve is immediately positioned to the minimum allowed position, of 30%. From there, the PID function begins to position the valve to achieve the flow rate set point. The feed pump is ramped up slowly, so the valve will open rapidly at first and then close down as the feed flow rises. Tuning the PID parameters is done on the PID FEED FLOW screen.

iii. Auto Vibrate – When the system is in filtration mode, and the auto vibrate button is enabled, vibration will be started once the pressure setpoints have been reached. When vibration starts, the drive motor goes to a pre-set speed. This pre-set speed is equal to the Minimum Frequency setpoint configured in the drive motor VFD. After a timed interval, (~15 seconds), the speed is increased slowly to the desired setpoint which produces 1/2" amplitude at the base of the filter pack. In order to change the amplitude, the frequency speed setpoint must be changed. In order to protect the equipment, a maximum allowable frequency parameter is used. This would prevent amplitude greater than 7/8" peak to peak. Both amplitude set points need to be manually set up for the first time based on visual inspection of vibrational amplitude stickers affixed to the Filter Pack. Vibration continues until a stop command is received or the pressure falls below the set points. Note that the set point will change based on new filter packs, new feed materials, hot bearing oil, as the weight/bearing friction would change the properties of motor loading at the same speed set point.

5.1.5] Filtration Start Up:

Prior to start up in Filtration Mode, a flush cycle must have been completed. This may have occurred from an Auto Flush, Alarm Flush, CIP Flush, or an intentional Manual Flush. Such low pressure purging will insure that the filter pack is clear of obstructions and all the air is purged out, (the filter pack is full). **Using high pressure on an empty filter pack can delaminate the membrane trays.** Air pockets can lead to membrane failure during vibration due to lack of Trans-Membrane pressure for the affected area. Also, by using this method, initiating filtration mode introduces concentrated feed slurry, which will be diluted upon entry to the filter pack and thus allows for a smooth transition into filtration.

<u>VSEP Filtration Sequence of Events:</u>

- With the system in STANDBY MODE and with no active alarm conditions, the operator first selects FILTRATION MODE and sets the feed pressure, concentrate flow and start/stop batch feed tank level. Then presses the start button.

- Upon the start command signal, the Feed Pump ramps up slowly to the Feed Pressure Set point. Several other sequences are occurring simultaneously, so the ramp speed must be slow. The concentrate flow control valve will modulate and try to hold 20 GPM (dependant on filter pack design). Until the system gets optimized, permeate and concentrate are re-circulated back to the feed tank.

- As the Trans-Membrane Pressure, (Concentrate Pressure - Permeate Pressure) passes 35 psi, the VSEP drive motor starts and ramps up quickly to "Pre-Vibration" speed, which is a drive frequency that will produce 1/8" amplitude on the filter pack.

- After a timed interval, the drive motor ramps up slowly to "Vibration" speed that would equate to 1/2" amplitude.

- After full vibration and a concentrate flow rate of about 20 GPM, all valves on the system orient to send permeate and concentrate to their destination tanks.

- End of batch will be indicated once the tank level reaches end of batch level set point. There will be a 5minute end of batch flush.

5.1.6] Flush Overview:

It is extremely important to flush the filter pack when ever the VSEP stops in order to remove waste water from the filter pack, as the foulants can form a cake layer at the membrane surface hence plugging the filter pack. There are two modes of flushing as stated below:

i) Manual CIP Flush Mode:

<u>General Description</u>

This operating mode is used to manually flush the Filter Pack. It is different than the Alarm Flush and Auto Flush, which are performed automatically. During a Manual CIP Flush cycle, hot water is sent via CIP pump to the Filter Pack with permeate and concentrate going to the reclaim drain sewer.

<u>Sequence of Events - Manual Hot Water Flush</u>

- ❖ The system operator sets the system for CIP FLUSH MODE and modifies any set points as needed. The machine must already be stopped.

- ❖ The system operator selects Flush mode from the Status screen.

- ❖ The automatic Hot Water In valve opens to feed hot water directly to the CIP pump ahead of the filter pack.

- ❖ The valves orient for a Flush operation so that the system sends concentrate and permeate to the drain. The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset concentrate flow rate. (no less than 8 gpm, 20 gpm is preferable)

- ❖ The Feed Pump ramps up slowly to the Feed Pressure Set point, ~50 psi, (345 kpa).

- ❖ The concentrate flow control valve will modulate and try to hold the set point

- ❖ As the Trans-Membrane Pressure, (Concentrate Pressure - Permeate Pressure) passes 30 psi, (207 kpa), the VSEP drive motor starts and ramps up quickly to "Pre-Vibration" speed. After a timed interval, the drive motor ramps up slowly to "Vibration" speed, which would equate to 3/4" amplitude.

❖ This flushing operation will continue until timed interval has expired. Then, the vibration and feed pump will stop and the CIP skid valves will close

Note: In order to repeat the entire procedure above or if the procedure needs to be interrupted or to repeat the cycle, the operator should change the operation mode from FLUSH MODE to another mode, (OFF-LINE would be best) and then back to FLUSH MODE.

ii) Auto Flush Mode:

General Description
These operating modes flush the Filter Pack directly from CIP Skid, or through the Feed Pump Skid, depending on the type of flush. This sequence will be initiated automatically when the VSEP is stopped by an Alarm Shutdown condition, a low or high tank level condition, or by timed interval set point.

Alarm Shut Down Flush
Alarms are the most important part of the VSEP PLC. They cause the whole system to stop completely. If the alarms are working properly, the filter pack will be protected against errors in other parts of the program, against most common sensor failures as well as most operator errors. Set point ranges for the alarms are configurable. Some examples of common alarms include:

VSEP Alarms
(Triggered only in Filtration Mode, filter pack is flushed with water through CIP pump)
High Feed Pressure.
High Concentrate Pressure.
High Permeate Pressure.
Low Feed Pressure.
Low Minimum Trans-Membrane Pressure
High Differential Pressure
Low Permeate Flow
High Permeate Flow
Low Concentrate Flow
High Concentrate Flow
Feed Pressure Without Vibration.
Vibration Drive Fault
High Vibration Drive Motor Load.
High Permeate Conductivity

System Shutdown Alarms
(Triggered only in Filtration Mode, filter packs are flushed with water through feed pumps)
Low Feed Temperature
High Feed Temperature
Feed Pump Failure
Low Feed Tank Level
High Permeate Tank Level
High Bag Filter Differential Pressure

Cleaning Cycle Alarms
(Cycle stops and waits for operator, filter pack is not flushed as CIP skid is not available)
Low CIP Temperature
High CIP Temperature
Low CIP pH
High CIP pH
High CIP Tank Level
High Feed Conductivity

After an Alarm Shut Down, the VSEP is isolated by valve orientation and drive motors will stop. Then there is a system pause, which would allow the system operator enough time to cancel the automatic flush, which is about to occur. After a time out, the flush sequence commences.

The valves orient so that the unit is flushed from the CIP and the concentrate and permeate are sent to the drain; (system alarms will shutdown all filter packs and flush through the VSEP Feed Pump Skid, during this type of flush the permeate and concentrate will be sent to final destination tank). This condition continues for a pre-set timed interval or until the operator presses the STOP button.

The system will remain in Shut Down Mode and cannot be restarted until the operator clears the Alarm and the condition which caused it.

Note: If CIP skid is in cleaning, a VSEP can not be flushed until the CIP system is free.

Timed Auto Flush
Based on timers it is possible to flush all VSEPs through the feed pump skid. This has been known to lengthen time between cleanings. Also after system has been flushed it will go back online for filtration.

Auto End of Batch Flush
The VSEP's will be flushed automatically with hot water once a filtration batch has been completed.

5.1.7] Cleaning (CIP) Mode:

i) Auto Cleaning (CIP) Mode:

General Description:
This operating mode is used to clean the Filter Pack by using a FLUSH – WASH (acidic) - CIP RINSE- FLUSH – WASH (caustic) - CIP RINSE - FLUSH cycle. During a FLUSH cycle, hot water is pumped through the Filter Pack with permeate and concentrate going to the drain for a set timed interval. During a WASH cycle, the contents of the CIP tank, which would include chemical cleaners, are recirculated back to the CIP tank for a timed interval. After completion the contents are drained. During a CIP RINSE the contents from the CIP Tank are drained and the tank is rinsed with water and prepared for second wash cycle.

Timed Cleaning:

At a configurable preset timed interval of operation in filtration mode, a single VSEP will be pulled off line automatically and will initiate a cleaning cycle via CIP skid. Simultaneously the other VSEP's will continue operating in filtration mode. This can happen after a certain number of hours of operation have elapsed.

Sequence of Events:

- The automatic Hot Water In valve opens to fill the CIP tank if it is not already full.
- At the same time, the NLR 404 chemical tote metering pump begins to dispense the appropriate amount of chemical cleaner into the CIP tank. This would be done by configuring a time set point that would allow the proper amount of cleaner to be transferred from the tote to the tank. (setpoints optimized by field service engineer during installation)
- Once the VSEP is taken off line, the valves orient for a hot water FLUSH operation. The Hot Water is sent to the VSEP unit to be cleaned directly from the Hot Water In valve on the feed pump inlet. Permeate and the concentrate are sent to the drain.

The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset concentrate flow rate. (20 gpm is preferable).

- After a timed interval of flushing, the system orients to initiate a WASH (acidic) cycle from the CIP tank. Once the system is ready, valves orient and the feed pump begins to ramp up. Constant Pressure Control will be used as an operating method with a set point of 50 psi and a sub routine for a PID Loop controlling the concentrate flow at 20 gpm. If the permeate rate is high and the system is not capable of reaching 50 psi, the pump will ramp until the feed flow is 80 gpm or to full speed whichever comes first.

- If safe transmembrane pressure is achieved (30 psi), the vibration will initiate to the "Pre-Vibration speed equal to 1/8" amplitude and then after a timed interval increase to 1/2" amplitude speed

- At the beginning of the cleaning cycle, valves orient so the concentrate will be sent to the drain until the CIP tank level reaches 75% to avoid reintroducing most foulants into the cleaning solution. When the tank level is reached the concentrate valves switch so that they are recirculated back to the CIP tank.

- This operation then continues for a configurable timed period, (45 minutes). Then after this timed interval, the concentrate valve again switches back to a drain destination. This then reduces the CIP tank volume and this step continues until the tank is drawn down when the feed pump and vibration will stop

- Once the Wash cycle is complete and the feed pump and vibration have stopped, the CIP Feed valve to the VSEP will close and the Hot Water In valve to the CIP tank opens for a short CIP RINSE. The CIP tank drain valve opens automatically after a configurable timed setpoint and will purge out any chemical cleaner contents or foulants from the CIP Tank. The configurable set point may vary depending on how foamy the cleaners are.

- Then the same procedure repeats for the second FLUSH – WASH (caustic) – CIP RINSE – FLUSH cycles.

- After final flushing, the CIP valves close, and the valves to the process feed pump open. The VSEP will resume back to filtration mode.

Note: In order to repeat the entire procedure above or if the procedure needs to be interrupted and starting over is desired, the operator should reset the system by changing the operation mode from CLEANING MODE to another mode, (OFF-LINE would be best) and then back to CLEANING MODE.

Note: Vibration is desirable during rinsing or cleaning as it will prevent re-fouling by foulants dislodged from the cleaning. Cleaning and rinsing are generally more effective with vibration; however, vibration is not mandatory.

Operating Set points for Auto CIP Mode:

- TANK LEVEL FOR WASH: The % level at which the CIP filling operation is done
- TANK LEVEL FOR RECIRC: The CIP tank is level at which permeate and concentrate are sent back to the tank
- WASH LENGTH: The time period for the wash cycle is set here
- FLUSH LENGTH: Can be used to set timed interval of rinsing, or let the tank draw down
- FEED PRESSURE: Operating pressure for wash and flush cycles.
- CONCENTRATE FLOW RATE: Concentrate flow rate for during the cleaning cycle to provide adequate cross flow and efficient cleaning.

ii) Manual Cleaning (CIP) Mode:

<u>General Description</u>

- ❖ Manual Cleaning Mode follows the same principle as Auto Cleaning Mode, as stated above. After stopping the system due to low permeate fluxes or high permeate conductivity, the system operator sets the system for manual CLEANING MODE and modifies any setpoints as needed. Then the operator presses the start button to initiate. The sequence of events are the same as above. However at the end of the cleaning cycle the system will stop and go to Standby Mode.

Note: It is assumed that daily hot water flushing will work well in some cases. However it is estimated that three to four times per week, of NLR404 and NLR 505 chemical cleaning would be needed. Also is it estimated that once per month a NLR404 and NLR505 back to back cleaning would be prudent. All of this will be determined during operation and start up of the system.

RO Spiral Control Strategy

Customer: HSP Panama Landfill
Membrane: ESPA and LFC3-LD
Feed Material: Landfill Leachate
Suggested Preservatives: Water, and NLR 103

1] Filtration Overview:

The Spiral RO will be run in ***"single pass"*** mode. To maintain the ~80% recovery the exit concentrate flow control valve will be throttled. The inter stage tanks before (feed tank) and ahead (permeate/concentrate destination tanks) of the Spiral RO will be monitored. If these tanks get down to a configurable low/high level set point, it will automatically stop the RO skid pumps and a manual flush will have to take place.

Flushes and cleaning cycles are available for Spiral RO skid, but they need to be made manually.

2] Controls Parameters:

Included in your system are three main control parameters consisting of Permeate Flow rate, % Recovery, and Cross Flow Control. These control parameters consist of configurable set points.

i) Permeate Flow Control - The RO Spiral system will be run at constant filtrate flow, which will mean that the pressure through the RO Spiral units will vary depending on the degree of fouling with time. Flow rates at each unit would gradually decrease as the membrane fouls, and the VFDs on the feed pumps will speed up or down so that the end result would meet the design configurable permeate flow set point.

   Because of variations in the VSEP Permeate tank level (spiral feed tank) are likely to occur, tweaking of the constant Permeate Flow set point will be done automatically based on feed tank level in order to maintain a continuous operation and avoid frequent starting and stopping of the system which would safeguard against possible damage to the pumps. Unless the tank is below Low Level, RO Spiral system will initiate the Filtrate Flow Control and try to pace itself with tank level. Many variables will affect the performance of each spiral unit. The actual GFD is only an estimate, different membranes may foul at different rates, actual achieved % Recovery across unit may vary slightly, and many other factors will produce actual flow rates which vary both up and down from the original estimates. The estimated calculations are considered nominal flow rates. For this reason, the RO Spiral system will need to be tuned or adjusted to create a balance, which is optimum. Also see Note-1 and 2 below.

ii) Volumetric % Recovery – In order to accomplish the ending % recovery of permeate, a material balance between feed, permeate, and concentrate must be maintained at a fixed ratio. Flow rates at each RO Spiral would gradually decrease as the membrane fouls. Permeate flow as a percentage of feed flow will be calculated and the concentrate from the spiral system will be throttled by means of a flow control valve so that the end result would meet the design set point for % Recovery. The % Recovery target value is a configurable set point. The current design basis calls for a %Recovery of about 85% recovered as permeate and the remaining reject volume will be about 6gpm.

iii) Cross Flow Control: The Spiral RO system needs to have a constant cross flow to ensure minimum fouling. Cross flow will help keep the feed material homogenous and flowing, prevent plugging, fouling and thus reduce cleaning frequency.

3] Filtration Mode:

i) Concentrate Valve Control: Included in the program are two main control methods for the Concentrate Valve.

1. Valve Always Open - The valve is opened to a set position during start up of the system. Concentrate flow may vary.
2. Concentration Ratio - The valve throttles flow to maintain a constant concentration ratio in accordance with % recovery.

The concentrate flow control valve will follow a Flow Control PID loop with a subroutine for holding a flow set point during start up. The control variable for the PID loop is the flow measurement from the concentrate flow meter. The process variable is the concentrate valve position (0-100% Open). Once the feed pumps have ramped up and the desired permeate flow has been stabilized, the % recovery function takes over which will calculate the concentration ratio. The PLC program will scan the Feed Flow, (which in this case is equal to the Permeate flow plus the Concentrate flow), and adjust the concentrate control valve to hold set amount of flow. The PID function begins to throttle the valve to achieve the % Recovery set point.

ii) Feed Pump Control: The spiral feed pumps will be controlled via a means of a VFD control and will try to reach a configurable Start up Feed Pressure. Once this pressure has been achieved the pumps will be ramped accordingly in order to achieve a set Permeate Flow Rate. The flow rate will vary during the operation especially as the material becomes more viscous during concentration. The control system will monitor the permeate flow rate as a single input and the feed pumps will hunt to hold the specific configurable flow rate set point.

iii) Start/Stop Control: starting from the Local Control Panel, if the system is ready, the operator may start the system by using the START button at the local control panel. For the system to be ready, the following conditions must be met.

- System Manual Valves must be correctly orientated for Filtration.
- The system must be set for Filtration Mode.
- The latching STOP button must be released or pulled out.
- The system must not be stopped by an alarm.
- The Feed Tank must be more than 20% full (configurable set point).

Once the number of passes have been optimized the conductivity meter located on the permeate line can be used in correlation to determine the final permeate quality.

4] Filtration Start-up:

<u>Sequence of Events</u>

1. Upon the start command signal, the system checks the feed tank level and verifies appropriate level to start pumps.
2. Upon the start command signal, the Feed Pump(s) ramp up slowly to the configurable Feed Pressure Set point.
3. VFD's will adjust the pump speed to try to hold a specific permeate flow set point.
4. The % Recovery Mode will take over (throttling the exit concentrate valve), once the concentrate recycle flow rate has been achieved and the permeate flow has been stabilized along with operating pressure. The system will run until the PLC receives a stop command.

5] Flush Overview:
Two modes of flushes are available as described below:

iii) Auto Flush Mode:

General Description
This operating mode flushes the spiral membrane modules directly from the hot water inlet to the feed pump. During this sequence the flush water is pumped directly into the spiral system where the inlet valves to the feed pump switch over from feed to hot water. Permeate and concentrate valves orient to go to appropriate destinations.

This type of flush would occur if the destination tanks are full, the feed tank is below 5% or during an alarm shutdown condition

Sequence of Events – Auto Alarm Flush Mode
1. After an Alarm Shut Down, the drive motor and feed pump will stop. Then there is a system pause, which would allow the system operator enough time to cancel the automatic flush, which is about to occur. After a time out, the flush sequence commences.

2. The valves orient so that permeate and concentrate are sent to appropriate destinations.

3. Hot water in valve opens to the feed pump. The pressure adjusts to 50 psi and the concentrate flow is trimmed to a configurable set point.

4. After the Flush, the pumps will stop, valves will close and the system will standby and cannot be restarted until the operator clears the Alarm and the condition which caused it. The operator will have the option to perform a manual cleaning or to restart the batch of product.

iv) Manual Flush Mode:
General Description
Follows the same principle as Auto Flush Mode. However this operating mode is used to manually flush the spiral membrane modules.

Sequence of Events - Manual Hot Water Flush
1. The system operator sets the system for FLUSH MODE and modifies any set points as needed. The machine must already be stopped.

2. The system operator presses the START button. The valves orient and the automatic Hot Water In valve opens to feed Hot Water directly to the feed pump.

3. After the configurable flush time length the pumps will stop and the system will standby.

Operating Set points used in Auto & Manual Flush Mode

- TIME FOR FLUSH: Set the desired number of minutes for an appropriate flush cycle
- PRESSURE FOR FLUSHING: Select a number which corresponds to the desired feed pressure for Flushing (50 psi)
- FLOW RATE FOR FLUSHING: Select a number which will correspond to the Concentrate flow rate during Flushing.

6] Cleaning (CIP) Mode:

i) Auto Cleaning (CIP) Mode:

General Description

This operating mode is used to clean the Filter Pack by using a FLUSH 1 – WASH (acidic) –CIP RINSE – FLUSH 2 - WASH (caustic) – FLUSH 3 cycle. During a flush cycle, hot water is pumped through the RO membranes with the concentrate going to the drain or chemical treatment sewer. During a wash cycle, the contents of the CIP tank, which would include chemical cleaners, are recirculated back to the CIP tank for a timed interval. After completion the contents are drained and CIP tank is rinsed and prepared for second wash (caustic). During the final flush cycle, hot water is pumped through the filter pack with permeate and concentrate going to drain for a set timed interval.

For the Spiral RO skid cleanings are intended to be less frequent due to the fact that the feed is NF permeate.

Sequence of Events

- *Wash cycle preparation:*
  - The system should be stopped. The system operator sets the system for cleaning mode, modifies any set points as needed.
  - The Hot Water in valve opens to fill the CIP tank if it is not already full. Simultaneously, appropriate amount of chemical cleaner is added into the CIP tank from the chemical metering skid.
- *Flush 1:*
  - The Hot Water is sent to the spiral membranes directly from the "hot water in" valve located on the CIP skid. Permeate and concentrate valves will oriented automatically such that they are sent to the drain. The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset configurable concentrate flow rate. If there is not enough water pressure, the flow control valve on the concentrate may be 100% open.
  - After a configurable flush time (typically 5mins) has elapsed, the system will stop automatically.
- *Wash Cycle (acid):*
  - The system orients to initiate a wash cycle from the CIP tank after the flush cycle. Appropriate valves are orientated automatically and permeate and concentrate lines are sent to drain until the CIP tank level reaches 75%. This is to avoid reintroducing most foulants into the cleaning solution. When the tank level is reached, permeate and concentrate valves will be switched automatically so that they are recirculated back to the CIP tank.
  - Once the system is ready and started, the pump begins to ramp up. Constant Pressure Control will be used as an operating method with a set point of 50 psi and a sub routine for a PID Loop controlling a preset configurable concentrate flow.
  - This operation then continues for a configurable timed period, (typically 30-45 minutes). Then after this timed interval, the concentrate valve orients to drain, thus reducing the CIP tank volume. This step continues until the tank is drawn down.
- *CIP Rinse:*
  - Once the Wash cycle is complete and the pump has stopped, and once the CIP tank is drained, the CIP Feed valve to the spiral will close and the Hot Water In valve to the CIP tank opens to purge chemicals and cleaners out of the CIP tank. The CIP tank drain

valve opens automatically for a configurable timed set point. The configurable time set point may vary depending on how foamy the cleaners are.

- *Flush 2:*
  - Follows the same principle as flush 1 cycle, however for a longer period of time (typically 10mins). Since that this rinse is between the two wash cycles, it is important to make sure that if not all, most of the previous chemical cleaner has been purged out of the system.

- *Wash Cycle (caustic):*
  - Follows the same principle as the acid wash cycle. However a caustic cleaner will be used in this wash instead of an acid cleaner.

- *Flush 3:*
  - Follows the same principle as previous flushes. The configurable flush time is set to about 5mins.

Note: Periodically it may be necessary to perform repeated cleanings, so the number of wash cycles is not limited and can be repeated as needed.

i) Manual Cleaning (CIP) Mode:

General Description

Manual Cleaning Mode follows the same principle as Auto Cleaning Mode, as stated above. After stopping the system due to low permeate fluxes or high permeate conductivity, the system operator sets the system for manual CLEANING MODE and modifies any set points as needed. Then the operator presses the start button to initiate the operation. The sequence of events are the same as above. However at the end of the cleaning cycle the system will stop and go to Standby Mode.

Operating Set points used in Cleaning Mode:

- TANK LEVEL FOR WASH: The % level at which the CIP filling operation is done
- TANK LEVEL FOR RECIRC: The CIP tank is level at which permeate and concentrate are sent back to the tank
- WASH LENGTH: The time period for the wash cycle is set here
- FLUSH LENGTH: Can be used to set timed interval of rinsing, or let the tank draw down
- FEED PRESSURE: Operating pressure for wash and flush cycles.
- CONCENTRATE FLOW RATE: Concentrate flow rate for during the cleaning cycle to provide adequate cross flow and efficient cleaning.

Note: It is assumed that daily hot water flushing will work well in some cases. However it is estimated that 2-3 times per month, of NLR404 and NLR 505 chemical cleaning would be needed. Also is it estimated that once every couple of months a NLR404 and NLR505 back to back cleaning would be prudent. All of this will be determined during operation.

7] Alarm Conditions that trigger an Alarm:

These alarms must cause the whole system to stop completely. Alarms are the most important part of the spiral PLC program. If the alarms are working properly, the membranes will be protected against errors in other parts of the program. They will also protect against most common sensor and/or meter failures as well as most operator errors.

1. High Feed Pressure.
2. High Concentrate Pressure.
3. High Permeate Pressure.

4. Low Feed Pressure.
5. High Differential Pressure
6. Low Permeate Flow
7. High Permeate Flow
8. Low Concentrate Flow
9. High Concentrate Flow
10. Low pH (pH1).
11. High pH (pH1)
12. High Feed Temperature.
13. High Permeate Conductivity
14. High Permeate Tank Level.

SDL- Santo Domingo Landfill Project

VSEP/SPIRAL PROCESS LINE DESTINATION	STAGE-1 , 1X 84" RO VSEP			STAGE-2, S7200 Spiral		
Operation Mode	**Feed**	**Permeate**	**Concentrate**	**Feed**	**Permeate**	**Concentrate**
Normal Fitration Mode (Single Pass process)	T-110	T-200	T-120	T-200/210	On-Spec = T-300, Off-Spec = T-210	T-120
Optional Fitration Mode (Batch process)	T-110	T-200	Batch = T-110, End of Batch = T-120	T-200/210	On-Spec = T-300, Off-Spec = T-210	T-120
System Alarm, Auto, Timed and End of Batch Flushes	T-130	T-200	T-120	T-130	T-300	T-120
404 & 505 Cleaning (both cleanings go to the same place)	T-190	T-190	T-190	T-190	T-190	T-190
CIP tank drawdown (after chemical cleaning)	T-190 (from T-130)	Drain/Sump	Drain/Sump	T-190 (from T-130)	Drain/Sump	Drain/Sump
Flush CIP Tank	T-130	Drain/Sump	Drain/Sump	T-130	Drain/Sump	Drain/Sump
Cleaning Flushes (3 flushes within the chemical cleaning cycle)	T-130	T-120	T-120	T-130	T-120	T-120

Technical Summary

Filter Pack Cleaning Procedure

Customer: Relleno Sanitario Santo Domingo de los Tsachilas
Membrane: ESPA and LFC3-LD
Feed Material: Landfill Leachate
Suggested Preservatives: Water, and NLR 103

When is Cleaning needed?
The VSEP should be rinsed and then cleaned when or before the permeate rate reaches 50% of its initial stabilized flow rate value, after the flow rates are temperature and pressure corrected. It should also be cleaned before any prolonged period of inactivity. The system should also be flushed with warm water after or during any alarm shutdowns, scheduled maintenance shutdowns, or emergencies. Regular cleaning schedules will depend on the performance of each VSEP on an individual basis. The frequency of cleaning is programmable and may vary from once per day to once per month depending on actual performance to be determined during startup. The cleaning frequency will also vary between the two membranes, due to feed materials, operating conditions, and membrane life.

Hot Water Flushing Procedure: (For Flushing Only without Cleaning)
This step is completed in Flush Mode by flushing with hot water (50-60ºC) for 5 minutes sending the permeate and sending the concentrate to their destination tanks. Use a feed pressure of approximately 50 psi and amplitude of 1/2”.

Optimum Cleaners:
Typically the best chemical cleaning procedure for this application is the use of NLR 404 and NLR 505 cleaners on an as needed basis. NLR 505 is a caustic cleaner containing mostly chelating agents and surfactants. Use of this cleaner will dissolve those foulants which are soluble in medium to high pH such as organics and silica. 404 is an acidic based cleaner and can be used to remove those things soluble in acid such as mineral scale. Warm water and pH adjusting are critical to the success of the cleaning.

Cleaning Procedure:
The first step is to rinse the VSEP with warm to hot water (≤60ºC) single pass to the drain for 5 minutes at low pressure directly from the hot water line to the feed pump. Please do not exceed 80 gpm. After this flush, it is useful to get water flux data on the dirty filter pack. This will help you to verify the effectiveness of the cleaning procedure upon completion. Do this by measuring the permeate rate at the end of this rinse period, (single pass without re-circulation). The VSEP concentrate flow rate should be throttled to about 20gpm (dependent of filter pack design).

For chemical cleaning, prepare a 2-3% solution of NLR 404 or NLR 505 in your CIP tank. 200 gallons of cleaning solution is preferred. After hot water rinse, start the cleaning liquid flow into the pack and divert the first 15% to the drain. Then switch to recirculation so that the concentrate and permeate lines return to the CIP skid. Recirculate in this same way for 30-60 minutes. Then drain and rinse the CIP tank and rinse the pack again with hot water 50-60ºC for 10 minutes at low pressure (50 psi).

In order to properly verify if the membrane is clean, you should return to the feed material and compare your process flux numbers. Then you would possibly be able to correlate a process flux with a clean flush flux. Keep in mind that the most important parameter is whether you get your process flow rate back. Note that this process may need to be modified depending on fouling and from time to time you may need to use an alternative cleaner or repeated cleaning to better recover the membrane. Some of this optimization will be completed during start-up but there will also be some completed later on as your membrane begins to age.

Cleaning Procedure – Santo Domingo Landfill SDL

If there are any problems with your cleaning procedure then please contact New Logic Engineering as soon as possible for advice.

Approximate Timing for Cleaning:

Cleaner Description	Volume		Temperature	Time
	GPM	Total Gallons	(°C)	(Mins)
VSEP (typically once per day)				
1. Rinsing/flush with water prior to cleaning (feed directly into the VSEP).	60	300	50-60	5
2. NLR 404 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	60	200	50-60	30-45
3. CIP Tank Rinse.	60	50	50-60	5
4. Rinsing/flushing with water between caustic and acidic cleaning. (feed directly into the VSEP).	60	600	50-60	10
5. NLR 505 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	60	200	50-60	45-60
6. CIP Tank Rinse.	60	50	50-60	5
7. Final Flush (feed directly into the VSEP).	60	300	50-60	5
Miscellaneous steps inc prep time and mixing time				*20*
Totals		**1700**		**125-155**
RO SPRIAL (typically once per week)				
1. Rinsing/flush with water prior to cleaning (feed directly into the VSEP).	80	400	50-60	5
2. NLR 404 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	80	200	50-60	60
3. CIP Tank Rinse	60	50	50-60	5
4. Rinsing/flushing with water between caustic and acidic cleaning. (Feed directly into the VSEP).	80	800	50-60	10
5. NLR 505 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	80	200	50-60	60
6. CIP Tank Rinse.	60	50	50-60	5
7. Final Flush (feed directly into the VSEP).	80	400	50-60	5
Miscellaneous steps inc prep time and mixing time				*20*
Totals		**2100**		**170**

ESPA Membrane Specifications

Membrane Performance*		
	Water Flux	**35 GFD**
	Nominal Salt Rejection	**95.4%**
	Molecular Weight Cut Off	**40 Daltons**

Membrane Composition		
	Membrane Polymer	**Composite Polyamide**
	Membrane Surface Charge	**Neutrally Charged**
	Backing Material	**Non-woven Polyester**
	Supplier	**Hydranautics**

Process Condition Limits		
	Maximum Pressure	**600 PSI***
	Maximum Chlorine Concentration	**< 0.1 ppm**
	Maximum Operating Temperature	**60ºC (140ºF)**
	Allowable pH Range	**2.0 to 12.0**
	Feed Particle Size Limit	**250 microns (60 mesh)**

VSEP Module Construction*		
	Module Size	**84" Series I**
	Tray Spacing	**5/Inch**
	Membrane Area	**~1380 SF**
	FRP Housing Material	**8084 Vinyl Ester Resin**
	Plastic End Plates	**Polypropylene**
	Membrane Support Trays	**304 SS 18 ga**
	Diverter Support Trays	**304 SS 24 ga**
	Elastomers	**EPDM**
	Drainage Cloth	**Polypropylene "Tricot"**

***Test Conditions**: The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions: 1500 PPM NaCl solution, 300psi (2.07 MPa) Applied Pressure, 77 °F (25 °C) Operating Temperature, 6.5 - 7.0 pH. The performance is based on a 0.5 sq. ft. flat sheet membrane and is an average value from multiple batch cell tests.

***Maximum Pressure & VSEP Module Construction**: Standard units can be upgraded up to 1200 PSI and constructed with compatible material for special applications and upon request.

Notice: Permeate flow for individual elements may vary ± 30 percent. Elements are shipped with a preservative solution containing glycerin and anti-biological agents. New Logic believes the information and data contained herein to be accurate and useful. The information and data are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. New Logic assumes no liability for results obtained or damages incurred through the application of the presented information and data. It is the user's responsibility to determine the appropriateness of New Logic's products for the user's specific end uses. 03/16/01

NITTO DENKO

HYDRANAUTICS
www.membranes.com
A Nitto Denko Company

Membrane Element — LFC3-LD (Low Fouling Technology)

Performance:

Permeate Flow:	11,000 gpd (41.6 m^3/d)
Salt Rejection:	99.7 % (99.5 % minimum)

Type

Configuration:	Low Fouling Spiral Wound
Membrane Polymer:	Composite Polyamide Neutrally charged
Membrane Active Area:	400 ft^2 (37.1m^2)
Feed Spacer:	34 mil (0.864 mm) with biostatic agent

Application Data*

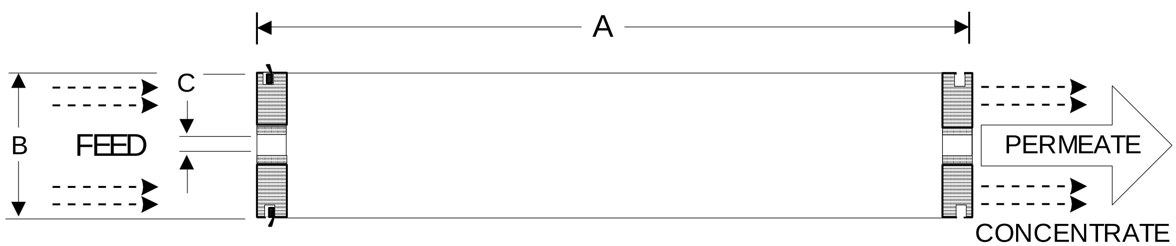
Maximum Applied Pressure:	600 psig (4.16 MPa)
Maximum Chlorine Concentration:	< 0.1 PPM
Maximum Operating Temperature:	113 °F (45 °C)
pH Range, Continuous (Cleaning):	2-10 (1-12)*
Maximum Feedwater Turbidity:	1.0 NTU
Maximum Feedwater SDI (15 mins):	5.0
Maximum Feed Flow:	75 GPM (17.0 m^3/h)
Minimum Ratio of Concentrate to Permeate Flow for any Element:	5:1
Maximum Pressure Drop for Each Element:	10 psi

***** The limitations shown here are for general use. For specific projects, operating at more conservative values may ensure the best performance and longest life of the membrane. See Hydranautics Technical Bulletins for more detail on operation limits, cleaning pH, and cleaning temperatures.

Test Conditions

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions:

1500 PPM NaCl solution
225 psi (1.55 MPa) Applied Pressure
77 °F (25 °C) Operating Temperature
15% Permeate Recovery
6.5 - 7.0 pH Range



A, inches (mm)	B, inches (mm)	C, inches (mm)	Weight, lbs. (kg)
40.0 (1016)	7.89 (200)	1.125 (28.6)	36 (16.4)

Notice: Permeate flow for individual elements may vary + or - 15 percent. Membrane active area may vary +/-4%. All membrane elements are supplied with a brine seal, interconnector, and o-rings. Elements are enclosed in a sealed polyethylene bag containing less than 1.0% sodium meta-bisulfite solution, and then packaged in a cardboard box.

 11/01/11

Hydranautics Corporate: 401 Jones Road, Oceanside, CA 92058
1-800-CPA-PURE Phone: 760-901-2500 Fax: 760-901-2578 info@hydranautics.com

NEW LOGIC
RESEARCH, INC.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 404 - Product Information

NLR 404 is revolutionary acidic, liquid membrane cleaner formulated to effectively remove metallic-based foulants and scaling components. It is proven to target metallic salts such as iron sulfate, aluminum sulfate, barium sulfate, calcium sulfate and calcium carbonate. In addition, it can also remove dyes and inks.

It uses a non-foaming formulation that reduces the cleaning time. NLR-404 provides the cleaning performance you desire at a fraction of the time.

At the recommended cleaning concentration of 3% the solution has a pH of 3.5 making it compatible with a wide range of membranes from microfilters to reverse osmosis. This cleaner is often paired with a more alkaline cleaner in a two-stage process to successfully remove a wider range of foulants.

Successful Applications where NLR-404 is used for cleaning include:

- Landfill Leachate
- Metal Hydroxide Waste streams
- High TDS Waste streams
- Calcium Carbonate Slurries and Washdown
- Plating Wastewater
- Streams containing metallic salts
- Used in conjunction with NLR-505 for various Pulp & Paper streams

Material Safety Data Sheet

NEW LOGIC RESEARCH, INC.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: **NLR 404**
Product Number: NA
Product Synonyms: Membrane Cleaner
Chemical Family: Acidic cleaner with detergents

MSDS Number: NLR 404
Publication Date: April 2, 2009

Company Identification: **New Logic Research, Inc.**
1295 67th Street
Emeryville, CA 94608 USA
510-655-7305 (For product information)
800-424-9300 (For Transportation Emergency)
Web Site: www.vsep.com

Phone: 510-655-7305
Fax: 510-655-7307

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
WARNING! EYE IRRITANT, SKIN IRRITANT

POTENTIAL HEALTH EFFECTS

Routes of Entry: Inhalation, skin, eyes, ingestion
Chemical Interactions: Reacts with alkaline materials to form salts, and corrodes many metals.
Medical Conditions Aggravated: None known.
Human Threshold Response Data Odor Threshold: Not established Irritation Threshold: Not established

Hazard Category Classifications and Ratings

Hazard Categories:	Health	Fire	Pressure	Reactivity	Reference 49 CFR 171.8, OSHA 29 CFR 1910.1200 and SARA 302/311/312/313.
Immediate	Yes	No	No	No	
Delayed	No	No	No	No	
HMIS Hazard Ratings: Health 2 Fire 0 Instability 0 Other B (Glasses, gloves)					
NFPA 704 Hazard Rating: Health 2 Flammability 0 Reactivity 0 Special NA					
Hazard Ratings: Least 0 Slight 1 Moderate 2 High 3 Extreme 4					

Immediate (Acute) Health Effects

Inhalation Toxicity: Not expected to be toxic by inhalation.
Inhalation Irritation: Moderately irritating to the eyes, nose, throat, and lungs.
Skin Contact: Skin contact may cause minor irritation consisting of transient redness and/or swelling.
Skin Absorption: No significant adverse effects to health would be expected to occur from incidental dermal contact.
Eye Contact: Contact may cause moderate irritation consisting of transient redness, swelling, and mucous membrane discharge to the conjunctiva.
Ingestion Irritation: Irritation may result.
Ingestion Toxicity: See Sec. 11 for animal toxicological results.
Acute Target Organ Toxicity: Eyes, skin, mucous membranes, respiratory tract

Prolonged (Chronic) Health Effects

Carcinogenicity:This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product. See Sec. 11 for animal study results.
Sensitization: No sensitizing effects known.
Inhalation: No information.
Skin Contact: Repeated or prolonged dermal contact may cause defatting of skin and/or dermatitis.
Skin Absorption: No information.
Ingestion: Chronic ingestion will chelate calcium in teeth and bones, weakening them.

Chronic Target Organ Toxicity: No data.
Supplemental Health Hazard Information: No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	SARA 313	Material or Component	%	RQ#	Exposure Limits TWA*	STEL*	WEEL*
Not Listed	No	Organic Acid	<50	None	Not Established		NE

No component is listed in "Threshold and Biological Exposure Indices for 2004" from ACGIH except as noted above. Components listed in Title III Sec. 313 (EPCRA) are indicated by "Yes" above. *TWA= Time Weighted Average; STEL= Short Term Exposure Limit; WEEL= Workplace Employee Exposure Level. NE= Not Established

4. FIRST AID MEASURES

Inhalation: IF INHALED: Remove individual to fresh air. Seek medical attention.
Skin Contact: IF ON SKIN: Flush skin with water, rinse thoroughly.
Eyes: IF IN EYES: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids apart. Call a physician immediately.
Ingestion: IF SWALLOWED: Immediately drink water to dilute. Consult a physician if symptoms develop. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): Non flammable water solution.

Flammable Properties
Flash Point None
Auto Ignition Temperature: Not applicable
Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable
Fire/Explosion Hazards: Material will not ignite or burn.
Extinguishing Media: Not Applicable. Choose extinguishing media suitable for surrounding materials.
Fire Fighting Instructions: In case of fire, use fire fighting equipment appropriate to the cause of the fire.
Hazardous Combustion Products: Will produce oxides of carbon if evaporated and burned.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation
Spill Mitigation Procedures:
Air Release: Not a likely scenario, nor source of personnel hazard.
Water Release: This material is soluble in water. Contain all liquid for treatment and/or disposal. Notify all downstream users of possible contamination.
Land Release: Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, earth or commercial absorbent), then place in a chemical waste container. Decontaminate all clothing and the spill area using a detergent and flush with large amounts of water. Contain all contaminated water for disposal and/or treatment.

Additional Spill Information: Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section XIII, Disposal Considerations.

7. HANDLING AND STORAGE

Handling: Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.
Storage: Do not store in metal container.
Shelf Life Limitations: See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage: Storage in original containers is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Equipment for Routine Use of Product Respiratory Protection:
Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or aerosols are generated, wear a NIOSH approved respirator.
General protective and hygienic measures: The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.
Eyes: Use chemical goggles.
Protective Clothing Type: Impervious
Exposure Limit Data : See Section II

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Odor: None
pH (@ 25 Deg. C): Acid
Bulk Density: Not applicable
Phosphorous %: 1.16
Vapor Pressure: (@ 25 Deg. C): No data
Volatiles % by vol.: Approx. 50% water
Freezing Point: Below 0'C

Color: Water white
Molecular Weight: Not Applicable for a solution.
Solubility in Water: Completely miscible
Specific Gravity: Approx. 1.2
Vapor Density (Air = 1): Not applicable
Evaporation Rate (Water = 1)Not applicable
Boiling Point: About 105'C

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary: Stable under normal conditions.
Reactive Properties:
Sensitivity to mechanical shock: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: None known.
Chemical Incompatibility: Reacts with alkaline and caustic materials.
Hazardous Decomposition Products: Oxides of carbon, nitrogen and sulfur if burned.
Decomposition Temperature: No data
Product May Be Unstable At Temperatures Above: No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology Data are for 100% organic acid from Alfa Aesar MSDS dated 3/11/02.
Irritation of skin: Moderate: 500 mg/24 hr (rbt)
Irritation of eyes: Severe: 750 ug/24 hr (rbt)
Inhalation LC50 value: No information.
LD 50mg/kg: 5040 (mus); 6730 (rat)

Skin Irritation: This material is expected to be moderately irritating.
Eye Irritation: This material is expected to be severely irritating.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product.
Sub acute to chronic toxicity: To the best of our knowledge the acute and chronic toxicity of this material is not fully known.
Carcinogenicity: This chemical is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

12. ECOLOGICAL INFORMATION

Ecological Toxicity Values: No data.

Do not allow material to be released to the environment without proper governmental permits.

13. DISPOSAL CONSIDERATIONS

Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all local, state and federal laws.

Waste Disposal Summary: Product as made has the characteristic of corrosivity, like " Unlisted Hazardous Waste D002", RQ 100#.
Potential US EPA Waste Codes: Not applicable
Disposal Methods: As a corrosive hazardous liquid waste, it should be disposed of in accordance with local, state and federal regulations.
Components subject to land ban restrictions: No components subject to land ban restrictions.

14. TRANSPORTATION INFORMATION

Proper Shipping Name: Corrosive liquid, acidic, organic, nos, 8, UN 3265, PG III
Emergency Response Guide Number ERG 153
Labels required per 49 CFR 172.101: Corrosive
Size for "Limited quantity" per 49 CFR 173.150-.155: 1 gal. max. in 66# max. container
Reportable Quantity ("RQ") per 49 CFR172.101: None or not possible in one non-bulk package
Aircraft - Passenger: 5 L
Aircraft – Cargo: 60 L
Vessel stowage- Location: A
Vessel stowage- Other (49 CFR 176.84): 40

15. REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

UNITED STATES:
Toxic Substances Control Act (TSCA): The components of this product are listed on the TSCA Inventory of Existing Chemical Substances.
Pesticide acceptance indication: US EPA Registration Number: Not applicable
Superfund Amendments and Reauthorization Act (SARA) Title III: See Section III of this MSDS.

Hazard Categories Sections 311/312 (40 CFR 370.2):
Health: Acute
Chronic Physical: None
Emergency Planning & Community Right to Know (40 CFR 355, App. A):
Extremely Hazardous Substance Section 302 - Threshold Planning Quantity: Not applicable
State Right-to-Know Regulations Status of Ingredients: No data.

Material Safety Data Sheet

INTERNATIONAL REGULATIONS:

Canadian Environmental Protection Act: All of the components of this product are included on the Canadian Domestic Substances List (DSL)
Canadian Workplace hazardous Materials Information System (WHMIS):
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.
WHMIS Classification: Not Available

European Inventory of Existing Chemical (EINECS): All of the components of this product are included on EINECS,
DSCL (EEC) R-36/38 Irritating to eyes and skin. S-24/25 Avoid contact with skin and eyes. S-26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S-28 After contact with skin, wash immediately with plenty of water. S-37/39 Wear suitable gloves and eye/face protection.

16. OTHER INFORMATION

LABEL REQUIREMENTS: WARNING! NUISANCE DUST COULD CAUSE COMBUSTIBLE DUST EXPLOSION.

Hazardous Material Information System (HMIS):	Health	2
	Flammability	0
	Reactivity	0
	Personal Protection	B

NFPA/HMIS Definitions: 0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme
Protective Equipment: GLASSES, GLOVES

Prepared By: Paul Eigbrett (MSDS Authoring Services)
Approval Date: April 04, 2009

Product Number: NLR 404
Supersedes Date: April 14, 2004

ADDITIONAL INFORMATION:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

END OF MSDS

NEW LOGIC
RESEARCH, INC.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 505 - Product Information

NLR 505 is a unique blend of surfactants and chelating agents in a caustic liquid membrane cleaner. This unique cleaner targets organics, biological components, lignins, dyes and oil & grease.

The NLR-505 cleaner is usually used in a 3% concentration resulting in a pH of 11.5. It is compatible with most microfiltration, ultrafiltration, nanofiltration and reverse osmosis membranes. The formula can be customized to control the pH to within the limits of your specific membrane.

This cleaner is often paired with the NLR-404 when a more comprehensive two-stage cleaning is needed to remove a wider range of foulants. This is strategic for waste streams as they tend to contain a variety of fouling bodies.

The liquid formula is ideal for automated CIP systems with chemical dosing and allows for ease of handling.

Successful Applications where NLR-505 is used for cleaning include:

- Laundry Wastewater
- Whitewater
- Black Liquor
- Organic wastewaters
- Surface Water treatment
- Fertilizer Streams
- Used in conjunction with NLR-404 for two stage cleaning

Material Safety Data Sheet

NEW LOGIC RESEARCH, INC.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: **NLR 505**
Product Number: NA
Product Synonyms: Membrane Cleaner
Chemical Family: Water solution of alkaline salts and detergents

MSDS Number: NLR 505
Publication Date: April 2, 2009

Company Identification: **New Logic Research, Inc.**
1295 67th Street
Emeryville, CA 94608 USA
510-655-7305 (For product information)
800-424-9300 (For Transportation Emergency)
Web Site: www.vsep.com

Phone: 510-655-7305
Fax: 510-655-7307

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
WARNING! EYE IRRITANT, SKIN IRRITANT

POTENTIAL HEALTH EFFECTS
Routes of Entry: Inhalation, skin, eyes, ingestion
Chemical Interactions: Contains chelator for many polyvalent metal ions.
Medical Conditions Aggravated: None known. Ingestion will chelator calcium in teeth and bones, weakening them.
Human Threshold Response Data: Odor Threshold: Not established, Irritation Threshold: Not established

Hazard Category Classifications and Ratings

Hazard Categories:	Health	Fire	Pressure	Reactivity	Reference 49 CFR 171.8, OSHA 29 CFR 1910.1200 and SARA 302/311/312/313.
Immediate	Yes	No	No	No	
Delayed	No	No	No	No	
HMIS Hazard Ratings: Health 1 Fire 0 Instability 0 Other B (Glasses, gloves)					
NFPA 704 Hazard Rating: Health 1 Flammability 0 Reactivity 0 Special NA					
Hazard Ratings: Least 0 Slight 1 Moderate 2 High 3 Extreme 4					

Immediate (Acute) Health Effects
Inhalation Toxicity: Not expected to be toxic by inhalation.
Inhalation Irritation: Moderately irritating to the eyes, nose, throat, and lungs.
Skin Contact: Skin contact may cause minor irritation consisting of transient redness and/or swelling.
Skin Absorption: No significant adverse effects to health would be expected to occur from incidental dermal contact.
Eye Contact: Contact may cause moderate irritation consisting of transient redness, swelling, and mucous membrane discharge to the conjunctiva.
Ingestion Irritation: Irritation may result. Ingestion will chelator calcium in teeth and bones, weakening them.
Ingestion Toxicity: See Sec. 11 for animal toxicological results.
Acute Target Organ Toxicity: Eyes, skin, mucous membranes, respiratory tract

Prolonged (Chronic) Health Effects
Carcinogenicity:This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product. See Sec. 11 for animal study results.
Sensitization: No sensitizing effects known.
Inhalation: No information.
Skin Contact: Repeated or prolonged dermal contact may cause defatting of skin and/or dermatitis.
Skin Absorption: No information.
Ingestion: Chronic ingestion will chelate calcium in teeth and bones, weakening them.

Chronic Target Organ Toxicity: No data.
Supplemental Health Hazard Information: No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	SARA 313	Material or Component	%	RQ#	Exposure Limits TWA*	STEL*	WEEL*
25155-30-0	No	Sodium dodecylbenzene sulfonate	<10	1000	Not Established		NE

Product also contains alkaline salts and non regulated detergents which may contribute to eye and skin irritation. No component is listed in "Threshold and Biological Exposure Indices for 2004" from ACGIH except as noted above. Components listed in Title III Sec. 313 (EPCRA) are indicated by "Yes" above. *TWA= Time Weighted Average; STEL= Short Term Exposure Limit; WEEL= Workplace Employee Exposure Level. NE= Not Established

4. FIRST AID MEASURES

Inhalation: IF INHALED: Remove individual to fresh air. Seek medical attention.
Skin Contact: IF ON SKIN: Flush skin with water, rinse thoroughly.
Eyes: IF IN EYES: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids apart. Call a physician immediately.
Ingestion: IF SWALLOWED: Immediately drink water to dilute. Consult a physician if symptoms develop. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): Non flammable water solution.

Flammable Properties
Flash Point None
Auto Ignition Temperature: Not applicable
Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable
Fire/Explosion Hazards: Material will not ignite or burn.
Extinguishing Media: Not Applicable. Choose extinguishing media suitable for surrounding materials.
Fire Fighting Instructions: In case of fire, use fire fighting equipment appropriate to the cause of the fire.
Hazardous Combustion Products: Will produce oxides of carbon, nitrogen and sulfur if evaporated and burned.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation
Spill Mitigation Procedures:
Air Release: Not a likely scenario, nor source of personnel hazard.
Water Release: This material is soluble in water. Contain all liquid for treatment and/or disposal. Notify all downstream users of possible contamination.
Land Release: Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, earth or commercial absorbent), then place in a chemical waste container. Decontaminate all clothing and the spill area using a detergent and flush with large amounts of water. Contain all contaminated water for disposal and/or treatment.
Additional Spill Information: Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section XIII, Disposal Considerations.

Material Safety Data Sheet

7. HANDLING AND STORAGE

Handling: Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.
Storage: No safety restrictions.
Shelf Life Limitations: See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage: Storage in original containers is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation: General exhaust ventilation is likely to be sufficient for general worker safety and comfort.
Protective Equipment for Routine Use of Product Respiratory Protection:
Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or aerosols are generated, wear a NIOSH approved respirator.
General protective and hygienic measures: The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.
Eyes: Use chemical goggles.
Protective Clothing Type: Impervious
Exposure Limit Data : See Section II

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Odor: None
pH (@ 25 Deg. C): Alkaline
Bulk Density: Not applicable
Phosphorous %: 1.94
Vapor Pressure: (@ 25 Deg. C): No data
Volatiles % by vol.: Approx. 84% water
Freezing Point: Close to 0'C

Color: Water white
Molecular Weight: Not Applicable for a solution.
Solubility in Water: Completely miscible
Specific Gravity: >1
Vapor Density (Air = 1): Not applicable
Evaporation Rate (Water = 1)Not applicable
Boiling Point: Close to 100'C

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary: Stable under normal conditions.
Reactive Properties:
Sensitivity to mechanical shock: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: None known.
Chemical Incompatibility: None known.
Hazardous Decomposition Products: Oxides of carbon, nitrogen and sulfur if burned.
Decomposition Temperature: No data
Product May Be Unstable At Temperatures Above: No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology Data:
No information found for such a dilute solution of these materials.
Irritation of skin: No information.
Irritation of eyes: No information.
Inhalation LC50 value: No information.
LD 50mg/kg: No information.

Skin Irritation: This material is expected to be slightly irritating.
Eye Irritation: This material is expected to be moderately to severely irritating.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product.
Sub acute to chronic toxicity: Animal studies with EDTA salts such as herein contained have reported convulsions, weight loss, liver, kidney, urethra and bladder changes. Fetotoxicity and developmental abnormalities have also been reported from studies on animals. To the best of our knowledge the acute and chronic toxicity of this material is not fully known.
Carcinogenicity: This chemical is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

12. ECOLOGICAL INFORMATION

Ecological Toxicity Values: No data.

Do not allow material to be released to the environment without proper governmental permits.

13. DISPOSAL CONSIDERATIONS

Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all local, state and federal laws.

Waste Disposal Summary: If this product becomes waste, it DOES NOT meet the criteria of a hazardous waste as defined under 40 CFR 261, in that it does not exhibit the characteristics of a hazardous waste of subpart C, nor is it listed as a hazardous waste under Subpart D.
Potential US EPA Waste Codes: Not applicable
Disposal Methods: As a non-hazardous liquid waste, it should be disposed of in accordance with local, state and federal regulations.
Components subject to land ban restrictions: No components subject to land ban restrictions.

14. TRANSPORTATION INFORMATION

Proper Shipping Name: Not Regulated
Emergency Response Guide Number: Not Applicable
Labels required per 49 CFR 172.101: None
Size for "Limited quantity" per 49 CFR 173.150-.155: Not Applicable
Reportable Quantity ("RQ") per 49 CFR172.101: None or not possible in one non-bulk package
Aircraft - Passenger: NA
Aircraft – Cargo: NA
Vessel stowage- Location: NA
Vessel stowage- Other (49 CFR 176.84): NA

15. REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

UNITED STATES:
Toxic Substances Control Act (TSCA): The components of this product are listed on the TSCA Inventory of Existing Chemical Substances.
Pesticide acceptance indication: US EPA Registration Number: Not applicable
Superfund Amendments and Reauthorization Act (SARA) Title III: See Section III of this MSDS.

Hazard Categories Sections 311/312 (40 CFR 370.2):
Health: Acute
Chronic Physical: None
Emergency Planning & Community Right to Know (40 CFR 355, App. A):
Extremely Hazardous Substance Section 302 - Threshold Planning Quantity: Not applicable
State Right-to-Know Regulations Status of Ingredients: No data.

Material Safety Data Sheet

INTERNATIONAL REGULATIONS:

Canadian Environmental Protection Act: All of the components of this product are included on the Canadian Domestic Substances List (DSL)
Canadian Workplace hazardous Materials Information System (WHMIS):
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.
WHMIS Classification: Class D-2B: Material causing other toxic effects (TOXIC).

European Inventory of Existing Chemical (EINECS): All of the componenets of this product are included on EINECS,
DSCL (EEC) R-22 Harmful if swallowed, R-37/38 Irritating to respiratory system and skin, R-41 Risk of serious damage to eyes. S-26 Incase of contact with eyes, rinse immediately with plenty of water and seek medical advice. S-29 Do not empty into drains. S-36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

16. OTHER INFORMATION

LABEL REQUIREMENTS: WARNING! NUISANCE DUST COULD CAUSE COMBUSTIBLE DUST EXPLOSION.

Hazardous Material Information System (HMIS):	Health	1
	Flammability	0
	Reactivity	0
	Personal Protection	B

NFPA/HMIS Definitions: 0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme
Protective Equipment: GLASSES, GLOVES

Prepared By: Paul Eigbrett (MSDS Authoring Services)
Approval Date: April 04, 2009

Product Number: NLR 505
Supersedes Date: April 15, 2004

ADDITIONAL INFORMATION:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

END OF MSDS

RE: Filter Pack Storage Procedure

Customer: SDL Santo Domingo Landfill
Membrane: ESPA
Feed Material: Landfill Leachate
Suggested Preservatives: NLR 103

MEMBRANE STORAGE SOLUTIONS

Sanitizing is only necessary for flushed or used membrane materials; new filter packs or membrane cut samples will not need any added solution as these are shipped from the Factory with Preservative.

Sanitizing as shown below is necessary for non-use of more than two weeks. Biological growth, for short term idle (less than two weeks), can be avoided by periodically flushing with warm water.

Preparing Filter Pack for Storage:

Step 1 After operation on VSEP machine, flush membrane with clean warm water at low pressure and high crossflow for at least 15 minutes. Clean the membrane as described in the cleaning procedure provided by New Logic.

Step 2 Fill the CIP tank with NLR 103 to 20% level.

Step 3 Run the machine for approximately 5 minutes and recirculate the solution as feed material and permeate the solution through the Filter Pack or Membrane. Run the machine at low pressure and high crossflow.

Step 4 Seal the Filter Pack Openings

Repeat this procedure every 60 days if temperature is below 80ºF and every 30 days if temperature is above 80ºF. For very long term storage, (4 months or more), the Filter Pack should be refrigerated or Consult New Logic for other procedures.

Note: *Drain out the NLR 103 stored in the filter pack and rinse the filter pack with fresh water before starting in filtration mode. Flushing for 20 minutes with clean water is usually enough. Flush first at low pressure with high crossflow, then, at high pressure.* ***This will be necessary for newly arriving Filter Packs from New Logic as they are shipped filled with water to preserve the membrane during shipment.***

NEW LOGIC
R E S E A R C H , I N C.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 103 - Product Information

NLR 103 is an effective preservative solution used to extend the life of membranes and prevent freezing during transportation. This solution can be utilized to maintain membrane integrity during periods where the filter is not in use. This preservative is also recommended for membranes being stored. The solution will prevent biological contamination to your membranes and allows for longer storage periods.

NEW LOGIC RESEARCH, INC.

1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

I. Product and Supplier Information

Product Name: NLR103
Product Number: NA
Product Synonyms: Membrane Preservative
Chemical Family or Formula: Water solution of 1,2-propanediol

MSDS Number: NLR103
Publication Date: 20-Aug-10

Supplier: New Logic Research, Inc.
1295 67th
Emeryville, CA 94608

Phone: 510-655-7305
Fax: 510-655-7307
Web page: www.vsep.com

Product Information: 510-655-7305
Transportation Emergency: 800-424-9300

II. Composition and Information on Ingredients

CAS #	SARA 313	Material or Component	%
57-55-6	No	1,2-propanediol	25
79-09-4		Propionic Acid	< 1

Toxicological Data on Ingredients: 1,2-propanediol: ORAL (LD50): Acute: 20000 mg/kg [Rat]. 22000 mg/kg [Mouse]. DERMAL (LD50): Acute: 20800 mg/kg [Rabbit].

III. Hazards Identification

Potential: Acute Health Effects:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of inhalation.
Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

IV. First Aid

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.
Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate

medical attention.
Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation: Not available.
Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.
Serious Ingestion: Not available.

V. Fire Fighting Measures

Flammability Summary (OSHA):
Non flammable water solution.

Flammable Properties
Flash Point: None
Autoignition Temperature: Not applicable

Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable

Fire/Explosion Hazards: Material will not ignite or burn.

Extinguishing Media:
Not Applicable. Choose extinguishing media suitable for surrounding materials.

Fire Fighting Instructions:
In case of fire, use fire fighting equipment appropriate to the cause of the fire.

Hazardous Combustion Products:
Will produce oxides of carbon, nitrogen and sulfur if evaporated and burned.

VI. Accidental Release Measures

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

VII. Handling and Storage

Handling:
Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.

Storage
Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area.
Shelf Life Limitations:
See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage:
Storage in original containers is preferred.

VIII. Exposure Controls and Personal Protection

Engineering Controls:
Provi General exhaust ventilation is likely to be sufficient for general worker safety and comfort.
respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection:
Splas Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or
Glove aerosols are generated, wear a NIOSH approved respirator.
Personal Protection in Case of a Large Spill:
Splas The usual precautionary measures for handling chemicals should be followed.
used Keep away from foodstuffs, beverages and feed.
BEFC Remove all soiled and contaminated clothing immediately.
Expo: Wash hands before breaks and at the end of work.
TWA: Avoid contact with the eyes and skin.
Consult local authorities for acceptable exposure limits.
Protective Clothing Type: Impervious

Exposure Limit Data : See Section II

IX. Physical Data

Physical State: Liquid
Color: Colorless. Clear
Odor: None
Specific Gravity: 1.02
Molecular Weight: 76.1
pH (@ 25° C): not available
Solubility in Water: Completely miscible
Bulk Density: Not applicable
Vapor Density (Air = 1): Not applicable
Vapor Pressure: (@ 25°C) No data
Evaporation Rate (Water = 1): Not applicable

Volatiles % by vol.: Approx. 75% water
Boiling Point: 214°F (100°C)
Freezing Point: -14°F (-11°C)

X. Stability and Reactivity

Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Incompatible materials, excess heat, exposure to moist air or water
Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.
Corrosivity: Non-corrosive in presence of glass.
Special Remarks on Reactivity:
Hygroscopic; keep container tightly closed. Incompatible with chloroformates, strong acids (nitric acid, hydrofluloric acid), caustics, aliphatic amines, isocyanates, strong oxidizers, acid anhydrides, silver nitrate, reducing agents.
Special Remarks on Corrosivity: Not available.
Polymerization: Will not occur.

XI. Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.
Toxicity to Animals:
Acute oral toxicity (LD50): 18500 mg/kg [Rabbit].
Acute dermal toxicity (LD50): 20800 mg/kg [Rabbit].
Chronic Effects on Humans: May cause damage to the following organs: central nervous system (CNS).
Other Toxic Effects on Humans:
Hazardous in case of ingestion.
Slightly hazardous in case of skin contact (irritant, permeator), of inhalation.
Special Remarks on Toxicity to Animals: Not available.
Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenic).
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.
Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause mild skin irritation. It may be absorbed through the skin and cause systemic effects similar to those of ingestion.
Eyes: May cause mild eye irritation with some immediate, transitory stinging, lacrimation, blepharospasm, and mild transient conjunctival hyperemia. There is no residual discomfort or injury once it is washed away.
Inhalation: May cause respiratory tract irritation.
Ingestion: It may cause gastrointestinal tract irritation. It may affect behavior/central nervous system(CNS depression, general anesthetic, convulsions, seizures, somnolence, stupor, muscle contraction or spasticity, coma), brain (changes in surface EEG), metabolism, blood (intravascular hemolysis, white blood cells - decreased neutrophil function), respiration (respiratory stimulation, chronic pulmonary edema, cyanosis), cardiovascular system(hypotension, bradycardia, arrhythmias, cardiac arrest), endocrine system (hypoglycemia), urinary system (kidneys), and liver.
Chronic Potential Health Effects:
Skin: Prolonged or repeated skin contact may cause allergic contact dermatitis.
Ingestion: Prolonged or repeated ingestion may cause hyperglycemia and may affect behavior/CNS (symptoms similar to that of acute ingestion).
Inhalation: Prolonged or repeated inhalation may affect behavior/CNS (with symptoms similar to ingestion), and spleen

XII. Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): >5000 mg/l 24 hours [Goldfish]. >10000 mg/l 48 hours [guppy]. >10000 mg/l 48 hours [water flea].
BOD5 and COD: Not available.
Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.
Special Remarks on the Products of Biodegradation: Not available.

XIII. Disposal Considerations

Care must be taken to prevent environmental contamination from the use of this material.

XIV. Transportation Information

DOT Classification: Not a DOT controlled material (United States).
Identification: Not applicable.
Special Provisions for Transport: Not applicable.

XV. Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,2-propanediol
Minnesota: 1,2-propanediol
TSCA 8(b) inventory: 1,2-propanediol

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:
WHMIS (Canada): Not controlled under WHMIS (Canada).
DSCL (EEC):
R21/22- Harmful in contact with skin
and if swallowed.
S24/25- Avoid contact with skin and eyes.
HMIS (U.S.A.):
Health Hazard: 2
Fire Hazard: 1
Reactivity: 0
Personal Protection: h
National Fire Protection Association (U.S.A.):
Health: 0
Flammability: 1
Reactivity: 0
Specific hazard:

Protective Equipment: Gloves. Lab Coat & apron. Vapor respirator. Vent hood. Be sure to use an approved/certified respriator or equivilent. Splash googles & face shield.

XVI. Additional Information

MSDS REVISION STATUS:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

SDL Project - Instruments Totals

Quantity	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
3	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
3	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
4	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
2	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
3	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
7	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
1	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	200-200000 uS	3-2850-52-42
3	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
1	1/4"	IFM Efector	Level Pressure Transmitter	316 SS, CoNiCr	-5-100 inH20	PN 2228
1	3/4"	GF Signet	pH Electrode	Polypro, Titanium, Viton	~	3-2726-00
1	~	GF Signet	pH Transmitter	~	0.0 to 14.0	3-9900-1
1	~	GF Signet	pH Display	~	~	3-2750-1
3	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
3	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
3	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ
39	Instruments Totals					

SDL Project - Instruments List

Stage-1 VSEP RO Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TIT-100	Feed Line	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
TE-100	Feed Line	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
AE/AT-100	Feed Line	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	200-200000 uS	3-2850-52-42
PDT-100	Bag Filter Inlet	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
PDT-101	Bag Filter Outlet	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
FIT-111	VSEP#1 Permeate Return Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
FIT-112	VSEP#1 Concentrate Return Line	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
PIT-100	Feed Header	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-110	VSEP#1 Feed Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-111	VSEP#1 Permeate Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-112	VSEP#1 Concentrate Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
AE/AT-101	Permeate Return Line	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
TSH-101	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-101	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
PSL-100	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ

CIP Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
AE-190	CIP/Feed Line	3/4"	GF Signet	pH Electrode	Polypro, Titanium, Viton	~	3-2726-00
AIT-190	CIP/Feed Line	~	GF Signet	pH Transmitter	~	0.0 to 14.0	3-9900-1
AIT-190	CIP/Feed Line	~	GF Signet	pH Display	~	~	3-2750-1
TIT-190	VSEP CIP Feed Line	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2351
TE-190	VSEP CIP Feed Line	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
LIT-190	VSEP CIP Tank, T-190	1/4"	IFM Efector	Level Pressure Transmitter	316 SS, CoNiCr	-5-100 inH20	PN 2228
TSH-190	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-190	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
PSL-190	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ

Stage-2 Spiral Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TE/TIT-200	Spiral Feed Line	1/2"	Effector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
TE/TIT-300	Spiral Feed Line	1/2"	Effector	Metric Adapter	316 SS	M18x1.5 to 1/2"	E 40107
AE/AT-200	Spiral Feed Line	3/4"	Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
PDT-200	Bag Filter Inlet	1/4"	Effector	DP Pressure Transmitter	316 SS, CoNiCr	0-150 psi	PN 2224
PDT-201	Bag Filter Outlet	1/4"	Effector	DP Pressure Transmitter	316 SS, CoNiCr	0-150 psi	PN 2224
PIT-200	Feed Header	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-201	Permeate Line	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-202	Concentrate Line	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
FIT-200	Concentrate Return Line	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
FIT-201	Permeate Return Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
FI-200	1st Stage Permeate Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
AE/AT-201	Permeate Return Line	3/4"	Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
PI-200	Stage-1 Permeate outlet	1/4"	Wika	Pressure Indicator	316SS	0-600psi	9768530-834
FI-200	Stage-1 Permeate outlet	1.5"	GPI	Flow Indicator	316 SS, Tungsten Carbide, PVDF	20-200GPM	G2S15N09GMB
PSL-200	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ
TSH-201	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-201	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429

Process Tank Instruments (provided by others)

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TSH-110	Transfer Pump P-110	1/4"	Unknown	Low Pressure Switch	Unknown	Unknown	Unknown
LIT-110	T-110, VSEP Batch Feed Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-120	T-120, VSEP Reject Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-200	T-200, VSEP Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-210	T-210, VSEP Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-300	T-300 Spiral RO Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	317 SS, CoNiCr	-5-300 inH21	PN 2228
LIT-130	T-130, Hot Water Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228

IFM Efector Flow Sensor Code Number Matrix

2" Flow	**SM2004**
1" Flow	**SM0504**

Code	Sensor Range
PN 2228	0-30 gpm (0-6.8 m3/hr)
PN 2226	0-160 gpm (0-36 m3/hr)
Code	Connection
-	Sensor with 24VDC power with 4-20mA output signal
Code	Cable
E18112	Washdown 4 pin M12 micro DC assemblies 5m

IFM Efector Pressure Sensor Code Number Matrix

Level	**PN 2228, E 18112**
Pressure	**PN 2222, E 18112**
DP	**PN 2226, E 18112**

Code	1/4" NPT Sensor Range
PN 2228	0-100 in H20
PN 2227	3-14 psi
PN 2226	7-36 psi
PN 2224	25-145 psi
PN 2223	76-362 psi
PN 2222	364-1450 psi
PN 2221	905-3625 psi
PN 2220	1450-5800 psi
Code	G1/4 BSPP Sensor Range
PN 2028	0-100 in H20
PN 2027	3-14 psi
PN 2026	7-36 psi
PN 2024	25-145 psi
PN 2023	76-362 psi
PN 2022	364-1450 psi
PN 2021	905-3625 psi
PN 2020	1450-5800 psi
Code	Connection
-	Sensor with 24VDC power with 4-20mA output signal
Code	Cable
E18112	Washdown 4 pin M12 micro DC assemblies 5m
E18113	Washdown 4 pin M12 micro DC assemblies 10m
E18111	Washdown 4 pin M12 micro DC assemblies 25m

IFM Efector Temperature Sensor Code Number Matrix

Temperature	**TN 2530, E 40107, E 18112**

Code	Sensors
TN 2530	24VDC power with 4-20 mA, -40 to 125 degC
TN 7530	Dual PNP, -40 to 125 degC

Code	Thermowell
UT 0028	M18x1.5 to 1/2" NPT male
Code	Cable
E18112	Washdown 4 pin M12 micro DC assemblies 5m
E18113	Washdown 4 pin M12 micro DC assemblies 10m
E18111	Washdown 4 pin M12 micro DC assemblies 25m

GF Signet pH Meter Code Number Matrix

Electrode	**3-2774-1**
Transmitter	**3-2750-2**
Preamp	**3-2750-3**
Bracket	**3-2750-4**
Code	pH Electrode
3-2726	Flat pH surface electrode
Code	Temperature Elements
-	3k Ohm RTD
00	PT1000 RTD
Code	Transmitter
3-9900	Sensor with preamplified Digital S3L or 4-20mA output signal
Code	Electronics
1	In-line (yellow body)
Code	Preamp
3-2750-1	In-line w/ Junction Box
Code	Bracket
3-9900.396	Angled

GF Signet Conductivity Meter Code Number Matrix

Meter	**3-2850-52-41**
Meter	**3-2850-52-42**
Code	Integral Mount System
3-2850	Conductivity Sensor Electronics
Code	Electronics Versions and Output Signal
51	Digital S3L output signal with EasyCal
52	4-20mA output signal with EasyCal
Code	Electrode
39	2839 Electrode, 0.01 cell
40	2840 Electrode, 0.1 cell
41	2841 Electrode, 1.0 cell
42	2842 Electrode, 10.0 cell
Code	Process Connection
D	ISO 7/1R 3/4
-	3/4" NPT

Signet 2850 Conductivity/Resistivity Sensor Electronics and Integral Systems

Universal Mount

Threaded J-Box

2850 Integral Conductivity System for in-line installations

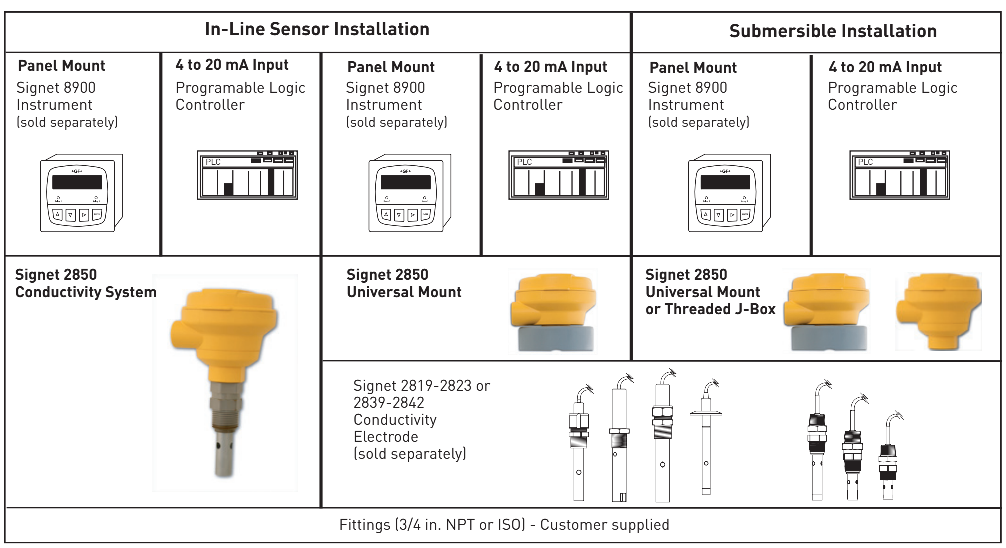
Description

The Signet 2850 Conductivity/Resistivity Sensor Electronics are available in various configurations for maximum installation flexibility. The universal mount version is for pipe, wall, or tank mounting and enables single or dual (digital versions only) inputs using any standard Signet conductivity / resistivity sensor. The threaded j-box version can be used with these same Signet sensors for submersible sensor mounting. It is also available as a combined integral system configuration for in-line mounting and includes a conductivity electrode in a choice of 0.01, 0.1, 1.0, or 10.0 cm^{-1} cell constants. The 2850 is ideal for applications with a conductivity range of 0.055 to 200,000 µS or a resistivity range of 18.2 MΩ to 10 kΩ.

All 2850 units are available with a choice of two outputs: digital (S^3L) or 4 to 20 mA. The digital (S^3L) output version allows for up to six sensor inputs directly into the Signet 8900 Multi- Parameter Controller. The two-wire 4 to 20 mA output is available with eight 4 to 20 mA output ranges for each electrode cell constant. Additionally, each range can be inverted and are field selectable by the user.

All 2850 units are built with NEMA 4X/IP 65 enclosures which allow wiring connections with long cable runs of up to 1,000 feet (305 m). EasyCal is a standard feature that automatically recognizes conductivity test solution values for simple field calibration. A calibration tool is available for validation of the sensor electronics according to USP requirements.

System Overview



Features

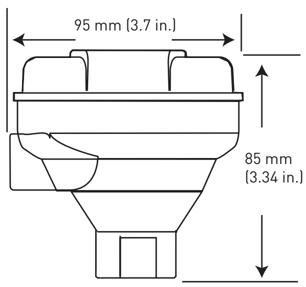
- Integral mount systems for quick and easy installation
- Compact design for maximum installation flexibility
- Digital (S^3L) interface or two-wire 4 to 20 mA output
- EasyCal with automatic test solution recognition
- Dual channel unit available for low cost installation with Signet 8900 Multi-Parameter Controller
- For use with ALL Signet conductivity electrodes

Applications

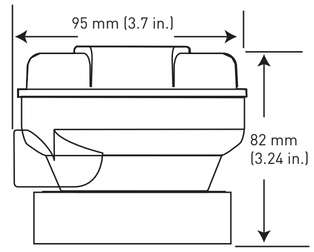
- Water Treatment & Water Quality Monitoring
- Reverse Osmosis
- Deionization
- Demineralizer, Regeneration & Rinse
- Scrubber, Cooling tower and Boiler Protection
- Aquatic Animal Life Support Systems

Dimensions

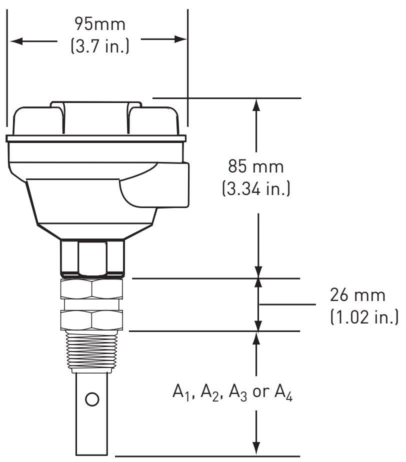
2850-5X threaded J-Box



2850-6X Universal Mount Systems



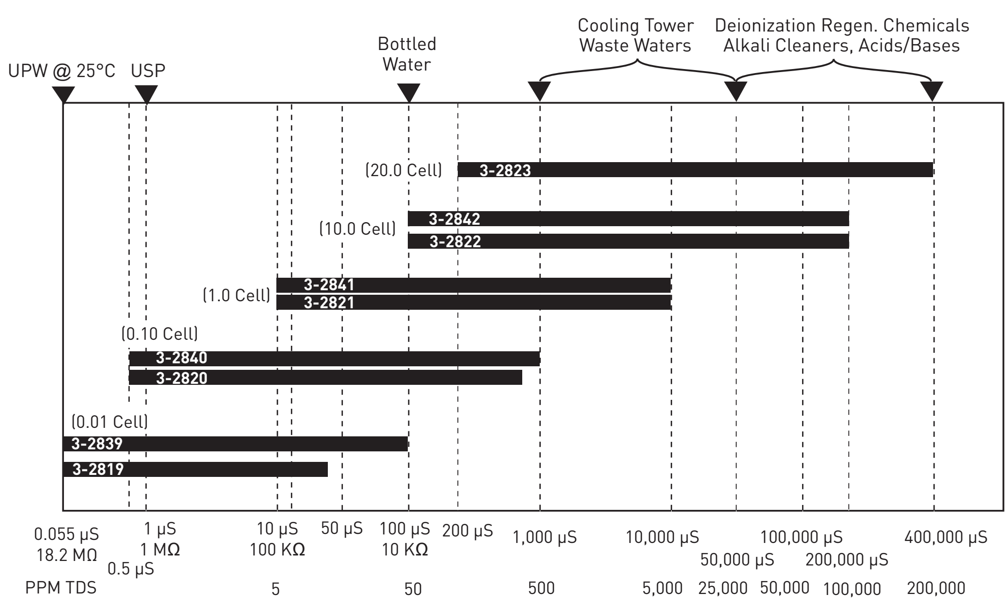
2850-5X-XX Integral Mount Systems



A_1 (3-2839) = 73mm (2.88 in.)
A_2 (3-2840) = 35mm (1.38 in.)
A_3 (3-2841) = 41.3mm (1.63 in.)
A_4 (3-2842) = 41.3mm (1.63 in.)

Operating Range Chart

The 2850 is capable of measuring conductivity and resistivity values over a wide range. Below is a chart of Signet Conductivity/Resistivity electrodes (listed in each range box) that are recommended for the specified measurement range.



Specifications:

General
Compatible Electrodes: All Signet models with PT-1000 RTD
Materials:
- Threaded j-box for Integral mount: PBT
- Universal/Remote mount: PBT, CPVC

Temperature Compensation:
PT-1000 RTD

Easy-Cal: Automatic recognition of the following conductivity values:
- 146.93 μS, 1408.8 μS, 12856 μS (@25°C) (Test solutions Per ASTM D1125-95)
- 10 μS, 100 μS, 200 μS, 500 μS, 1000 μS, 5000 μS, 10,000 μS, 50,000 μS, 100,000 μS (@25°C) (Standard test solutions)

Electrical
Power:
- 12 to 24 VDC for 4 to 20 mA output (typically called "Loop Powered")
- 5 VDC +/-5% regulated (provided by the Signet 8900), 3.0 mA max for Digital (S^3L) output (Reverse polarity and short circuit protected)

Digital (S^3L) Output: Serial ASCII, TTL level 9600 bps
- Accuracy:
  Conductivity: ±2% of reading
  Temperature: ±0.5°C
- Resolution:
  Conductivity: 0.1% of reading
  Temperature: < 0.2°C
- Update Rate:
  Single channel models: < 600 ms
  Dual channel models: < 1200 ms

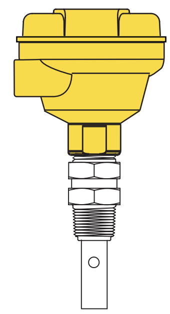
Electrical (continued):
Available data via Digital (S^3L) Output:
- Raw conductivity
- Calibrated conductivity
- Calibrated temperature-compensated conductivity
- Temperature

Error Indication: Open input and out of range diagnostics for temperature or internal electronic error.

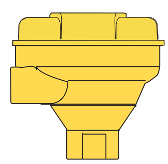
Current Output:
- Field-selectable ranges
- Factory set Span:
  0.01 cell (2819, 2839):
  4 to 20 mA = 0 to 100 μS
  0.10 cell (2820, 2840):
  4 to 20 mA = 0 to 1000 μS
  1.0 cell (2821, 2841):
  4 to 20 mA = 0 to 10,000 μS
  10.0 cell (2822, 2842):
  4 to 20 mA = 0 to 200,000 μS
  20.0 cell (2823):
  4 to 20 mA = 0 to 400,000 μS
- Max. Loop Resistance:
  50 Ω @ 12 VDC
  325 Ω @ 18 VDC
  600 Ω @ 24 VDC
- Accuracy: ±2% of output span
- Resolution: 7 μA
- Update Rate: <600 ms
- Error Indication: 22 mA
- Pure Water Compensation:
  When using 0.01-cm cell and raw conductivity value < 0.5 μS, the 2850 auto-switches to compensate for non-linear temperature effects found in this low conductivity (high resistivity) range

Shipping weight:
- Threaded j-box:
  0.75 kg (1.75 lb.)
- Universal mount:
  0.75 kg (1.75 lb.)

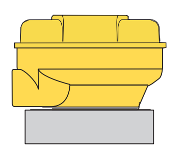
Standards and Approvals
- NEMA 4X/IP65
- CE
- Immunity: EN61326-1
- Emissions: EN55011 Class B
- Manufactured under ISO 9001:2000 for Quality and ISO 14001:2004 for Environmental Management



Integral System includes the 2850 sensor electronics and a choice of Conductivity/Resistivity electrode.



-5X threaded J-Box



-6X Universal/Remote Mount

Field Selectable Ranges for 4 to20 mA Operation

The chart below indicates the field selectable ranges in which the 2850 sensor electronics can be set via internal switches. All ranges can be inverted if required. Signet Models listed below are compatible Conductivity/Resistivity electrodes.

0.01 Cell	0.10 Cell	1.0 cell	10.0 Cell	20.0 Cell
Signet Model 2819 or 2839	Signet Model 2820 or 2840	Signet Model 2821 or 2841	Signet Model 2822 or 2842	Signet Model 2843
10 to 20 MΩ	0 to 2 μS	0 to 20 μS	0 to 200 μS	0 to 400 μS
2 to 10 MΩ	0 to 5 μS	0 to 50 μS	0 to 500 μS	0 to 1,000 μS
0 to 2 MΩ	0 to 10 μS	0 to 100 μS	0 to 1,000 μS	0 to 2,000 μS
0 to 1 MΩ	0 to 50 μS	0 to 500 μS	0 to 5,000 μS	0 to 10,000 μS
0 to 5 MΩ	0 to 100 μS	0 to 1000 μS	0 to 10,000 μS	0 to 20,000 μS
0 to 10 MΩ	0 to 200 μS	0 to 2000 μS	0 to 50,000 μS	0 to 100,000 μS
N/A	0 to 500 μS	0 to 5,000 μS	0 to 100,000 μS	0 to 200,000 μS
N/A	0 to 1,000 μS	0 to 10,000 μS	0 to 200,000 μS	0 to 400,000 μS
The 4 to 20 output ranges shown in this chart can be inverted using the internal switch **Resistivity Ranges are in BOLD**				

+GF+

Ordering Information

2850 Integral Systems

Use this ordering matrix when an integral 2850 system is desired (using 2839-2842 series electrodes). Integral systems are shipped with a sensor and 2850 combined. Other 2850 systems are available with Signet 2819 to 2823 electrodes upon request. See individual electrode product pages for more information.

Integral Mount System (includes Sensor Electronics and electrodes)				
3-2850	Conductivity and Resistivity Sensor Electronics			
	Output Type			
	-51	Digital (S³L) output with EasyCal		
	-52	4 to 20mA output with EasyCal		
		Sensor Option		
		-39	2839 Electrode, 0.01 cell	
		-40	2840 Electrode, 0.1 cell	
		-41	2841 Electrode, 1.0 cell	
		-42	2842 Electrode, 10.0 cell	
			Process threaded connection types	
			D	ISO threads
			-	NPT threads
3-2850	**-52**	**-39**		**Example Part Number**

2850 Sensor Electronics

Use this ordering matrix when remote sensor mounting is desired. The 2850-5X and 2850-6X are compatible with ALL Signet conductivity electrodes. See individual electrode product pages for more information.

Sensor Part Number			
3-2850	Conductivity Sensor Electronics with 4 to 20 mA or digital output		
	Mounting configurations		
	-5	3/4 inch threaded j-box for standpipe mounting, single input only	
	-6	Universal Mount Junction Box for remote mount, single or dual input	
		Output choices	
		1	one input/one Digital (S³L) output
		2	one input/one 4 to 20 mA output
		3	two inputs/two Digital (S³L) outputs (available for -6X versions only)
3-2850	**-5**	**2**	**Example Part Number**

Model 2850
Ordering Notes:

1) All 2850 units can be used with any Signet Conductivity/Resistivity electrode
2) Integral systems are only offered with Signet models 2839-2842 electrodes. However, they may be integrally mounted with the 2819-2842 series using a second threaded connection (sold separately) part numbers 3-2820.390 or 3-2820.391.
3) Dual channel units are only available in the universal/remote mount configuration and with digital (S³L) output for use with the 8900 instrument.

Application Tips:

- Maximum distance between sensor and 2850 electronics is 4.6m (15 ft.).
- Longer cable runs may result in small temperature compensation offsets, but can be adjusted through calibration in the 8900.

Please refer to Wiring, Installation and Accessories for more information.

Conductivity/ Resistivity

Mfr. Part No.	Code
3-2850-51	**159 001 398**
3-2850-51-39	**159 001 339**
3-2850-51-40	**159 001 340**
3-2850-51-41	**159 001 341**
3-2850-51-42	**159 001 342**
3-2850-51-39D	**159 001 343**
3-2850-51-40D	**159 001 344**
3-2850-51-41D	**159 001 345**
3-2850-51-42D	**159 001 346**
3-2850-52	**159 001 399**
3-2850-52-39	**159 001 347**
3-2850-52-40	**159 001 348**
3-2850-52-41	**159 001 349**
3-2850-52-42	**159 001 350**
3-2850-52-39D	**159 001 351**
3-2850-52-40D	**159 001 352**
3-2850-52-41D	**159 001 353**
3-2850-52-42D	**159 001 354**
3-2850-61	**159 001 400**
3-2850-62	**159 001 401**
3-2850-63	**159 001 402**

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-2850.101-1	**159 001 392**	Plug-in NIST traceable recertification tool, 1.0 μS simulated
3-2850.101-2	**159 001 393**	Plug-in NIST traceable recertification tool, 2.5 μS simulated
3-2850.101-3	**159 001 394**	Plug-in NIST traceable recertification tool, 10.0 μS simulated
3-2850.101-4	**159 001 395**	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated
3-2850.101-5	**159 001 396**	Plug-in NIST traceable recertification tool, 10.0MΩ simulated
3-2839-3	**159 001 355**	Electrode - 0.01 μS/cm, 6 in. cable, NPT
3-2839-3D	**159 001 359**	Electrode - 0.01 μS/cm, 6 in. cable, ISO
3-2840-3	**159 001 356**	Electrode - 0.1 μS/cm, 6 in. cable, NPT
3-2840-3D	**159 001 360**	Electrode - 0.1 μS/cm, 6 in. cable, ISO
3-2841-3	**159 001 357**	Electrode - 1.0 μS/cm, 6 in. cable, NPT
3-2841-3D	**159 001 361**	Electrode - 1.0 μS/cm, 6 in. cable, ISO
3-2842-3	**159 001 358**	Electrode - 10.0 μS/cm, 6 in. cable, NPT
3-2842-3D	**159 001 362**	Electrode - 10.0 μS/cm, 6 in. cable, ISO
5523-0322	**159 000 761**	Cable, 3-cond. plus shield, 22AWG

One transmitter
for multiple
measurements

Signet
9900 Transmitter

+GF+

GEORG FISCHER
PIPING SYSTEMS

Benefits

The 9900 Transmitter offers "at-a-glance" visibility, easy set-up and the flexibility to combine it with different parameters.

As a new member of the Signet SmartPro™ family of instruments, the Signet 9900 Transmitter provides a single channel interface for many different parameters including Flow, pH/ORP, Conductivity/Resistivity, Salinity, Temperature, Pressure, Level and other sensors that output a 4 to 20 mA signal.

9900 Transmitter – Panel and Field Mount

At-a-glance visibility
The highly illuminated display and extra large (3.90" x 3.90") auto-sensing backlit display can be viewed at 4-5 times the distance over traditional transmitters. Large characters are easily visible even in dark conditions. The display shows separate lines for units, main and secondary measurements as well as a "dial-type" digital bar graph.

Quick and easy installation
The intuitive menu system is consistent with ProcessPro® and ProPoint® transmitters.

With our PC COMM configuration tool you can easily set-up the parameters on your laptop.

Flexibility
One instrument for multiple measurements. Designed for complete flexibility, plug-in modules allow the unit to easily adapt to meet changing customer needs. Optional modules include Relay, Direct Conductivity/Resistivity, H COMM and a PC COMM configuration tool.

Relay Module

Direct Conductivity/Resistivity Module

H COMM Module

0251 Configuration Tool

Features

Default values are available for quick and easy programming and can be customised if desired.

For at-a-glance visibility, the 9900 Transmitter features a large auto-sensing backlit display, "dial-type" bar graph and relay and warning LEDs. The intuitive menu system is consistent with ProcessPro® and ProPoint® transmitters, assuring you of a quicker and easier installation. The optional Relay, Direct Conductivity/Resistivity, H COMM and PC COMM plug-in modules offers ease of use. The unit can be used with default values for quick and easy programming or can be customised with labelling, adjustable minimum and maximum dial settings, and unit and decimal measurement choices. The versatile device also allows third-party 4 to 20 mA signals to be used as an input (optional 8058 module required).

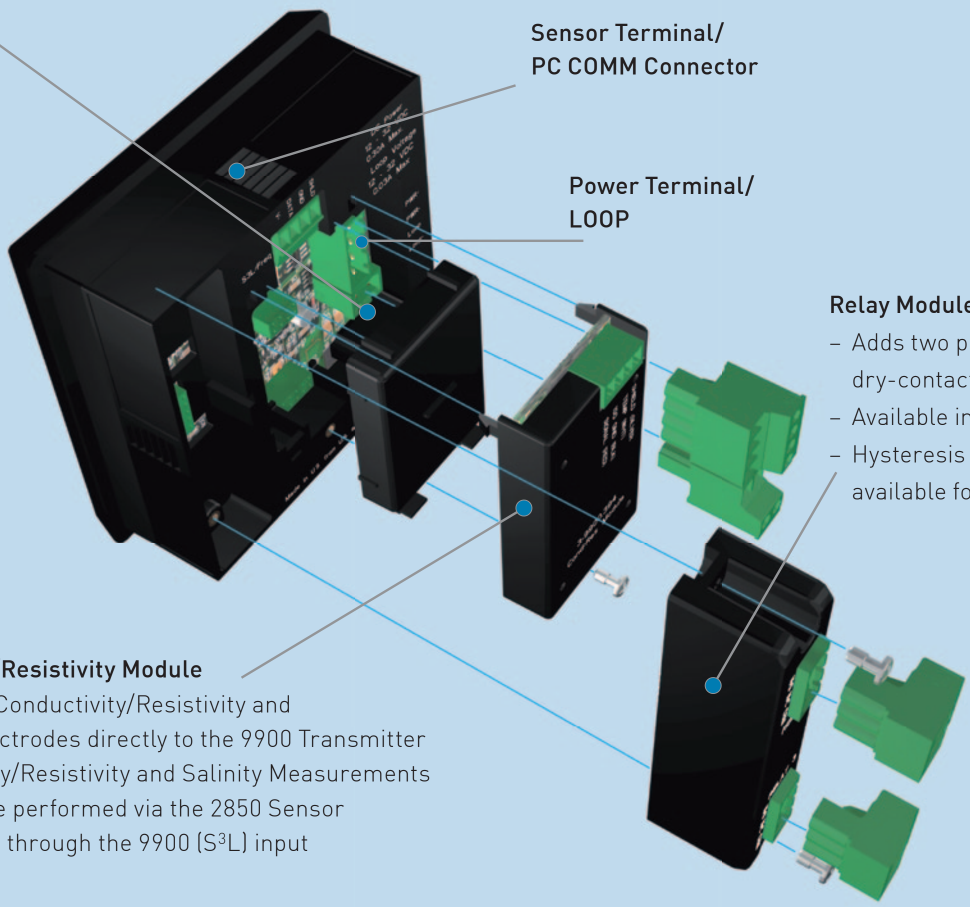
Features

One unit can replace ProPoint® and single-channel ProcessPro® instruments, dramatically reducing part numbers.

The 9900 Transmitter can be integrated in a panel unit or mounted in the field. Both configurations can run on 12 to 32 VDC power (24 VDC nominal) and can control many types of sensors on loop power.

H COMM Module
- Allows communication between the 9900 Transmitter and any HART® enabled device
- Allows access to Primary and Secondary measurements remotely
- Allows user to remotely adjust the 4 and 20 mA settings

PC COMM Module
- Enables configuration and programming from a PC
- Settings from one 9900 Transmitter can be saved to a PC and applied to future installations
- Compatible with Windows 7, Vista and XP



Relay Module
- Adds two programmable dry-contact relays
- Available in panel mount only
- Hysteresis and time delay available for each relay

Conductivity/Resistivity Module
- Interfaces Conductivity/Resistivity and Salinity Electrodes directly to the 9900 Transmitter
- Conductivity/Resistivity and Salinity Measurements may also be performed via the 2850 Sensor Electronics through the 9900 (S^3L) input

System Overview

The angle adjustment adapter kit quickly and easily converts your 9900 Field Mount Transmitter to any angle.

Additional accessories are available to help you with field installations. We provide solutions for field mounting by offering a separate mounting kit. The 3-8050 Universal Mount Kit, the 3-8051 or 8052 Integral Mount Kits, and the Angle Adjustment Adapter Kit enable the transmitter to be installed virtually anywhere. The adapter angles the transmitter by 25° degrees, allowing moisture to run off the display. The accessory enhances the versatility of the 9900 Field Mount Transmitter.

9900 Field Mount Transmitter
Field mounting requires a separate mounting kit. The 3-8050 Universal Mount Kit, the 3-8051 or 8052 Integral Mount Kits, and the Angle Adjustment Adapter Kit enable the transmitter to be installed virtually anywhere.

Angle Adjustment Adapter Kit
The angle adjustment adapter kit quickly and easily converts your 9900 Field Mount Transmitter to a 25° angle. This accessory enhances the versatility of the 9900 Field Mount Transmitter.

Mounting Kits
For Field Mount installations with a Conductivity/ Resistivity Module, the Angle Adjustment Adapter is required along with a 3-8050, 8051 or 8052 adapter kit to allow for sufficient clearance for the wiring.

Applications

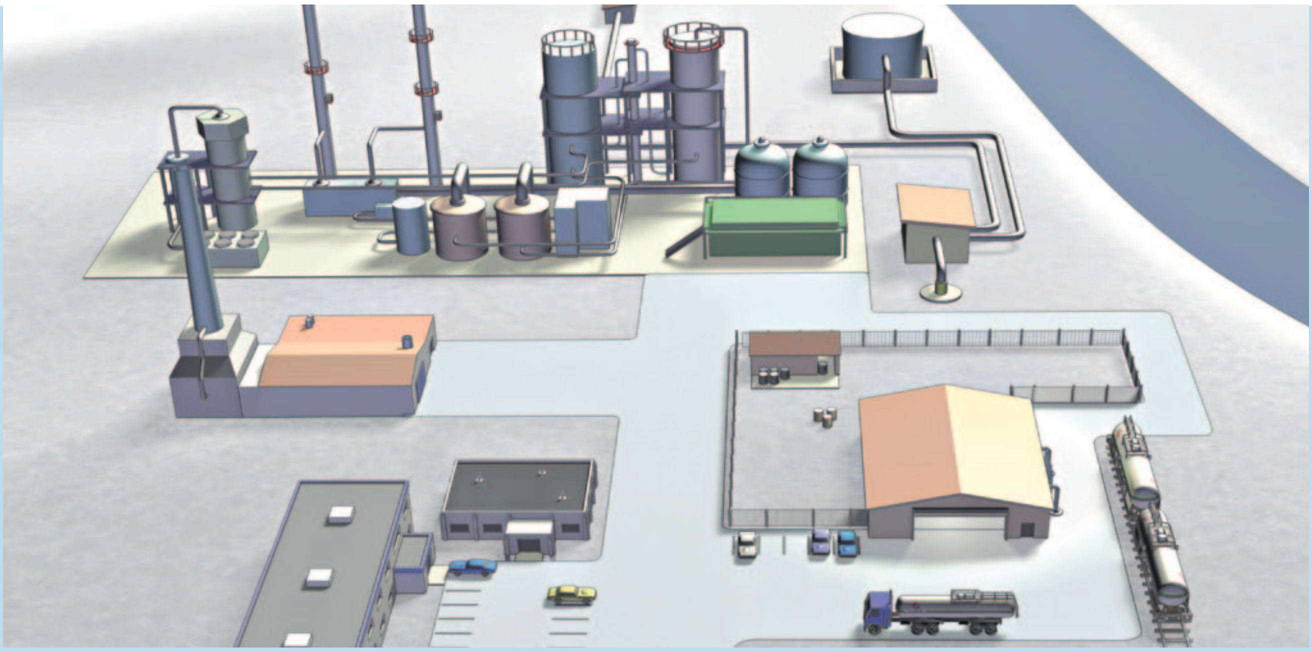
The 9900 Transmitter in a tank filling application.

The 9900 versatile parameter and modularity capabilities make the unit well suited for a variety of applications including wastewater treatment, reverse osmosis, deionisation, chemical manufacturing, metal and plastic finishing, fume scrubbers, cooling towers and media filtration.

Applications

No matter which processes and applications - GF Piping Systems supports its customers in every phase of the project.

From start to finish, we stand beside our customers as a competent, reliable and experienced partner, actively contributing the know-how of an industrial company that has been successful in the market for over 200 years. With our application knowledge and product expertise we support our customers during the planning process, the sustainable realisation of the projects and the provision of services.



Industrial & Municipal Water treatment
Water treatment, whether it is for municipal or industrial applications, typically serves to improve the quality of the water to ensure public safety or to reduce negative impacts on process equipment and/or the environment. The 9900 Transmitter, part of the new SmartPro family, is ideal for use in measurement and control of various water treatment applications. Industrial Water Treatment applications include media filtration, deionisation, desalination, cooling tower control, reverse osmosis, and fume scrubbers, while chlorine dioxide and ozone control are common in Municipal Water Treatment applications. Monitoring the quantity and quality of various parameters such as acidity/alkalinity of chemicals, salts, and chlorine concentrations are all important in delivering processed water to the quality standards demanded by each unique application.

Chemical process industry
The 9900 and applicable sensors can be used for measurement and control in the transport and dilution of various chemicals. Managing chemical tank levels and dosing of chemicals can all be monitored and controlled using the new 9900 Transmitter.

GF Piping Systems – worldwide at home

Our sales companies and representatives
ensure local customer support in over 100 countries.

www.gfsignet.com

The technical data is not binding. They neither constitute expressly warranted characteristics nor guaranteed properties nor a guaranteed durability. They are subject to modification. Our General Terms of Sale apply.

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PIPING SYSTEMS

Signet 2750 DryLoc® pH/ORP Sensor Electronics

In-line 2750

Submersible 2750

2750-7

DryLoc® Electrodes sold separately.

Features

- In-line integral mount and submersible installation versions
- Automatic temperature compensation
- Auto configuration for pH or ORP operation
- Optional EasyCal calibration aid with automatic buffer recognition
- Junction boxes for convenient wiring
- Patented DryLoc® connector provides a quick and secure connection to the sensor*

Applications

- Water and Wastewater Treatment
- Neutralization Systems
- Scrubber Control
- Effluent Monitoring
- Surface Finishing
- Flocculent Coagulation
- Heavy Metal Removal and Recovery
- Toxics Destruction
- Sanitization Systems
- Pool & Spa Control
- Aquatic Animal Life Support Systems

*U.S. Patent No.: 6,666,701

The Signet 2750 pH/ORP Sensor Electronics featuring the DryLoc® connector, provides a variety of functions to suit various requirements.

The 2750 has a preamplified signal and features two different outputs: a two-wire 4 to 20 mA loop output with EasyCal function or a digital (S^{3}L) output which allows for longer cable lengths and is compatible with the Signet 8900 or 9900 instruments.

The 2750 self-configures for pH or ORP operation via automatic recognition of the electrode type. The optional EasyCal feature allows simple push-button calibration and includes an LED indicator for visual feedback.

The DryLoc® electrode connector quickly forms a robust assembly for submersible and in-line installations. NEMA 4X junction enclosures are integral parts of the 2750 in-line version and are also available as accessories for the submersible 2750.

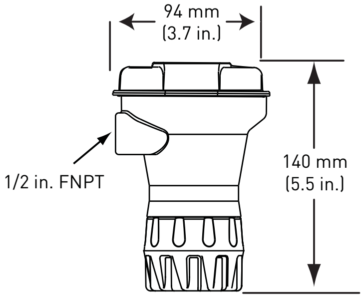
The 2750 submersible preamplifier can also be used as an In-line preamplifier when used with the 3/4" or 1" threaded sensors including the 2724, 2774 and 2764 series electrodes. The 2750 In-line preamplifier can be used with Signet fittings up to DN100 (4 in.) and wet-tap assemblies.

Specifications

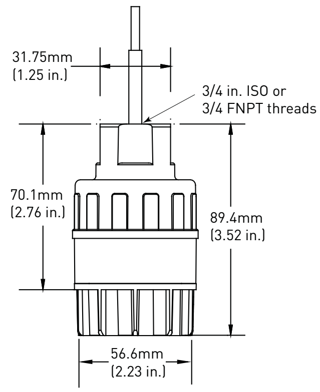
General			
Compatible Electrodes			
Signet DryLoc® pH and ORP Electrodes, Models 2724-2726, 2756-2757 Wet-Tap, 2764-2767, 2774-2777			
Operating Range	pH	0 to 14 pH	
	ORP	±2,000 mV	
Response Time	pH	< 6 sec. for 95% of change	
	ORP	application dependent	
Materials	In-line	Valox® (PBT)	
	Submersible	CPVC	
Electrical			
Cable	4.6 m / 15 ft	3-conductor shielded (3-2750-3 or -4 submersible sensor electronics only)	
	22 AWG	For 9900 and 4 to 20 mA max. cable length is 1000 ft. (For 8900 please refer to the Cable Calculation Table on pg. 333 for max. cable length)	
Power	12 to 24 VDC	±10%, regulated for 4 to 20 mA output	
	5 to 6.5 VDC	±5% regulated recommended, 3 mA max., for digital (S^3L) output	
Current Output	pH	Fixed 4 to 20 mA, isolated, = 0 to 14 pH (custom scaling available with 0250 tool)	
	ORP	Fixed 4 to 20 mA, isolated, = -1000 to 2000 mV (custom scaling available from ± 000 mV with 0250 tool)	
Max Loop Resistance	100 Ω max. @ 12 V	325 Ω max. @ 18 V	600 Ω max. @ 24 V
Accuracy	±32 μA		
Resolution	±5 μA		
Update Rate	0.5 seconds		
Error Indication	3.6 mA		
Digital (S^3L) Output	Serial ASCII, TTL level 9600 bps		
Accuracy	pH	± 0.03 pH @ 25 °C	± 0.03 pH @ 77 °F
	ORP	± 2 mV @ 25 ° C	± 2 mV @ 77 °F
Resolution	pH	≤ 0.01 pH	
	ORP	1 mV	
Temperature	≤ 0.2 °C	0.36 °F	
Update Rate	0.5 seconds		
Available Data	Raw mV, pH or ORP, temperature (pH)		
Error Indication	Open input diagnostic		
Input Impedance, Z	>10^{11}Ω		
Environmental			
Enclosure	3-2750-1 & -2	NEMA 4X/IP65 with electrode connected	
	3-2750-3 & -4	NEMA 6P/IP68 with electrode and watertight conduit and/or extension pipe connected	
Max. Temperature/Pressure Rating			
Operating Temperature			
submersible	0 °C to 85 °C	32 °F to 185 °F	
in-line	0 °C to 110 °C	32 °F to 230 °F	
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F	
Relative Humidity	0 to 95%, non-condensing (without electrode connected)		
Shipping Weight			
	2750-1 & 2	0.75 kg	1.65 lb
	2750-3 & -4	0.64 kg	1.41 lb
Standards and Approvals			
	CE, FCC		
	RoHS compliant, China RoHS		
	Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety		

Dimensions

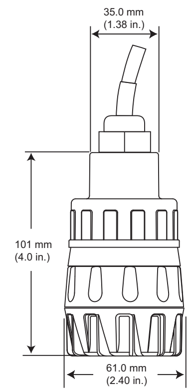
3-2750-1,-2



3-2750-3, -4



3-2750-7

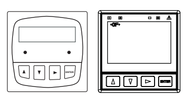


System Overview

In-Line Installation

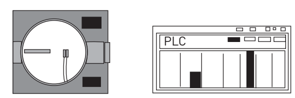
Panel Mount

Signet Instruments
8900 9900



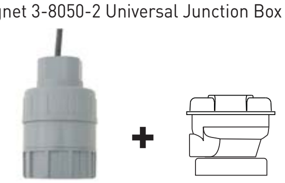
4 to 20 mA input

Customer Supplied Chart Recorder
or Programmable Logic Controller



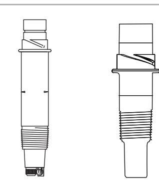
Signet 2750 Sensor Electronics

Signet 2750 Sensor Electronics
with Signet 3-8050-2 Universal Junction Box (EasyCal)



Signet 2750 Sensor Electronics

Signet Electrodes
2724-2726
2764-2767
2774-2777



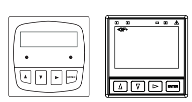
2724-2726 DryLoc® Electrodes: Use GF Fittings* or customer supplied 3/4 in. NPT fittings
2764-2767 and 2774-2777 DryLoc® Electrodes: Use customer supplied 3/4 in. or 1 in. NPT fittings

All sold separately

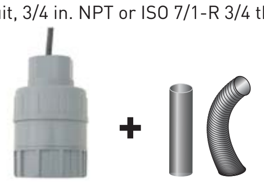
Submersible Installation

Panel Mount

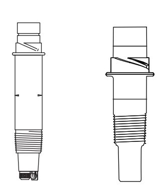
Signet Instruments
8900 9900



Signet 2750 Sensor Electronics
with customer supplied pipe extension or conduit, 3/4 in. NPT or ISO 7/1-R 3/4 threads**



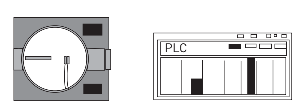
Signet Electrodes
2724-2726
2764-2767
2774-2777



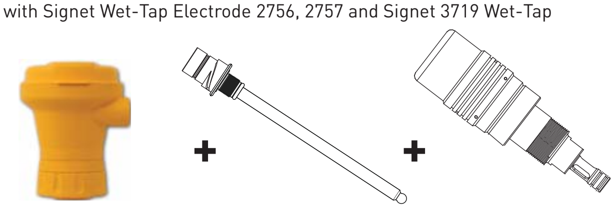
Wet-Tap Installation

4 to 20 mA Input

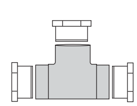
Customer Supplied Chart Recorder
or Programmable Logic Controller



Signet 2750 Sensor Electronics
with Signet Wet-Tap Electrode 2756, 2757 and Signet 3719 Wet-Tap



GF Tees and Fittings
see model 3719 for more info



All sold separately

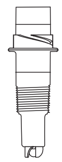
* See fittings section for more information.

2750 Product Selection Guide

1. Choose the Electrode

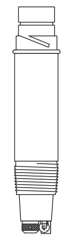
2724-2726

Can use Any 3-272x series Electrode



2764-2767 Differential

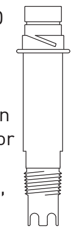
3-2764-1
3-2764-2
3-2766-1
3-2766-2



2774-2777

ORP electrodes must have 10K ID resistor use: 3-2775, 3-2777

pH Electrodes can be either the 1K or 3K use: 3-2774, 3-2774-1, 3-2776, 3-2776-1

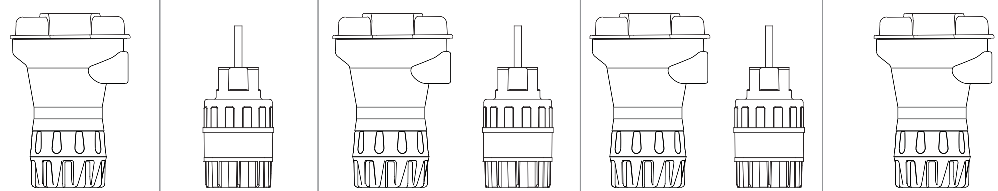


2756 and 2757 Wet-Tap

Can use any Wet-Tap 275x series electrode

2. Determine the mounting style:

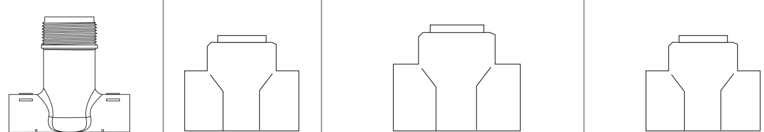
In-line



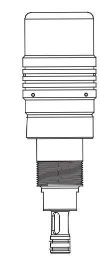
2750-1 or -2 | 2750-3 or -4 | 2750-1 or -2 | 2750-3 or -4 | 2750-1 or -2 | 2750-3 or -4 | 2750-1 or -2

And

-In-line fitting



Signet fitting | ¾" reducing tee | 1" threaded tee | ¾" reducing tee



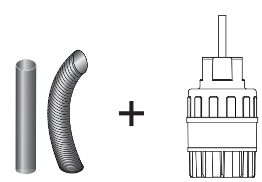
3719 Wet-Tap Assembly

(Submersible not applicable with Wet-Tap assembly)

Or

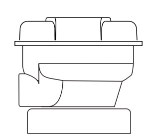
Submersible

2750-3 or -4 and cable conduit (customer supplied) connected to ¾" sensor electronics



3. Junction Boxes

3-8050-1: Use when extending the submersible cable over long distance.
3-8050-2: Use with the submersible 2750-3 or -4 and the in-line 2750-1 for best calibration results with the EasyCal function when using the blind 4 to 20 mA output.

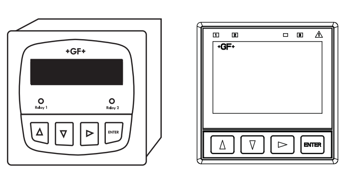


4. Choose the output instrument

Digital (S³L)

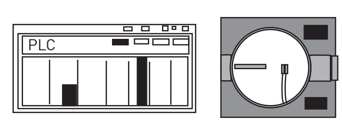
Or

4 to 20 mA



8900 or 9900 Instruments

OR



PLCs or Chart Recorders

Model 2750 Ordering Information

1) Model 2750 requires 12 to 24 VDC to function as a blind 4 to 20 mA output transmitter.

2) Order a 3-2750-2 or any other 2750 with a junction box 3-8050-2 if the EasyCal feature is desired.

3) Conduit and mounting brackets for submersion installation must always be used (customer supplied).

4) The 3-2759 System Tester must be ordered with the adapter cable 3-2759.391 for exclusive use with the 2750.

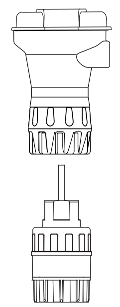
5) All sensor electronics, preamplifiers and connectors require a DryLoc® electrode for full system installation.

Application Tips

- The EasyCal feature automatically recognizes standard 4.0, 7.0, and 10.0 pH buffer or ORP quinhydrone solutions of 87 and 264 mV and simplifies calibration

- Frequency of calibration of electrodes is dependent upon the application.

Ordering Information



Mfr. Part No.	Code	Description
In-line Sensor Electronics (Yellow body)		
3-2750-1	**159 000 744**	Recommended for 8900 or 9900 instruments
3-2750-2	**159 000 745**	with EasyCal, recommended for 4 to 20 mA use
3-2750-7	**159 001 671**	pH electronics, Digital (S^3L), 4.6 m (15 ft) cable
Submersible Sensor Electronics (Grey body)		
3-2750-3	**159 000 746**	with 4.6 m (15 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2750-4	**159 000 842**	Submersible Sensor electronics with 4.6 m (15 ft) cable and ISO 7/1R 3/4 threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal

Sensor Electronics with preamplified signal and Digital (S^3L) output (for use with the Multi-Parameter Instruments) or 4 to 20 mA output - power supplied to unit dictates output type.

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
Calibration		
3-2700.395	**159 001 605**	Calibration kit: includes 3 polyproplyene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP system tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 adapter cable for use with 2750 -DryLoc® sensor electronics
3-0700.390	**198 864 403**	pH buffer kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10 buffer solution, 1 pint (473 ml) bottle
Mounting		
3-8050.390-1	**159 001 702**	Retaining nut replacement kit, Valox K4530
3-8050-1	**159 000 753**	Universal mount junction box
3-8050-2	**159 000 754**	Universal mount junction box w/EasyCal (for submersible applications, use with 3-2750-3/4 where 4 to 20 mA is required)
3-9000.392-1	**159 000 839**	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	**159 000 841**	Liquid tight connector kit, PG 13.5 (1 connector)
Other		
5523-0322	**159 000 761**	Sensor cable (per ft), 3-cond. plus shield, 22 AWG, black/red/white (for use with 2750)

3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com

Signet 2724-2726 pH/ORP Electrodes

Compatible with ALL Signet pH/ORP Instruments

Flat
Glass

Protected
Bulb

The Signet 2724-2726 pH and ORP Electrodes features a patented reference electrode design and uses the unique foul-proof patented DryLoc® connector. The large area PE reference junction and pathway is constructed to increase the total reference effectiveness and ensures long service life.

The DryLoc® connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2760 preamplifier or the 2750 sensor electronics. The robust Ryton® threaded sensor body and choice of flat pH, bulb pH, or flat ORP sensing elements provides broad range of chemical compatibility for a wide variety of applications. There are two optional pH sensing versions available, HF and LC. The HF version is for applications where traces of hydrofluoric acid (2% or less) will attack standard pH glass in levels of pH 6 and below. The LC version can be used for low conductivity fluids 20 - 100 µS/cm nominal and below 20 µS when mounted under controlled conditions.

The quick temperature response is available in either a PT1000 or 3 KΩ temperature sensor and allows compatibility with all Signet pH/ORP instruments. The 2724-2726 electrodes are general-purpose sensors ideal for a wide range of applications. The sensors incorporate ¾ inch NPT or ISO 7/1-R 3/4 threads for installing into standard pipe-tees. They can also be mounted directly into Signet standard fittings, DN15 to DN100 (½ to 4 inch)

Features

- **Patented reference design for exceptional performance ***
- **Mounts in Signet standard fittings from DN15 to DN100 (½ to 4 in.)**
- **¾" NPT or ISO 7/1-R 3/4 threaded sensors for use with reducing tees DN15 to DN100 (½ to 4 in.)**
- **Special design allows for installation at any angle, even inverted or horizontal**
- **Ryton® (PPS) body for broad range of chemical compatibility**
- **Patented DryLoc® connector with gold plated contacts**
- **Quick temperature response**
- **HF resistant glass available for trace HF of ≤2%**
- **Low conductivity sensor available for liquids down to 20 µS/cm**

Applications

- **Water & Wastewater Treatment**
- **Neutralization Systems**
- **Effluent Monitoring**
- **Sanitization Systems**
- **Pool & Spa Control**
- **Aquatic Animal Life Support Systems**
- **Process Control**
- **Cooling Towers**

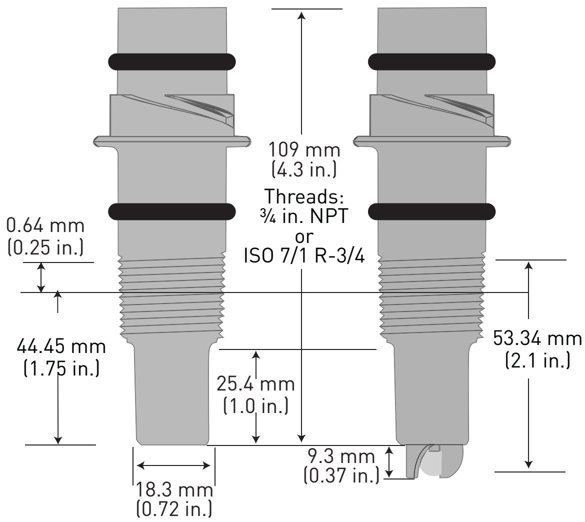
*U.S. Patent Nos.: 6,666,701, 7,799,193 B2, 7,867,371 B2 and 8,211,282 B2

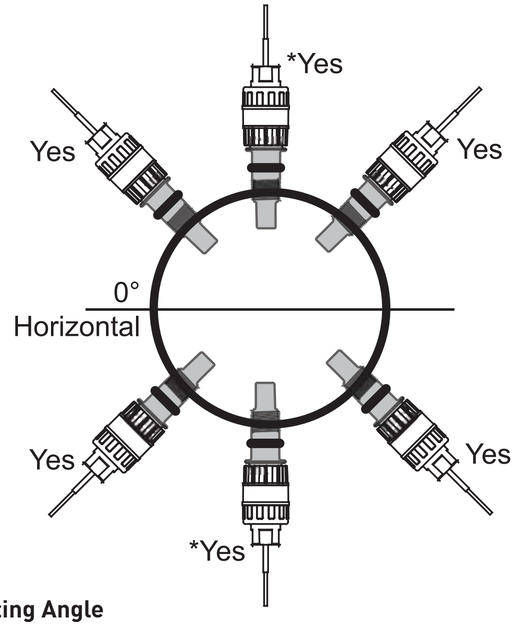
Specifications

General			
Performance	Efficiency	>97% @ 25 °C (77 ° F)	
Operating Range	pH	0 to 14 pH	
	ORP	±2000 mV	
	3-2726-LC	Low conductivity fluids; 20 - 100 μS/cm nominal < 20 μS; flow must be less than 150 ml/min in a properly grounded system	
	3-2726-HF	Hydrofluoric acid resistant glass, pH 6 or below; trace HF ≤2%	
Compatibility			
	2750 Electronic (for 8900, 9900, 4 to 20 mA), 2760 Preamplifier (8750)		
Temperature Sensor			
	PT1000 versions	compatible with Signet 2750 pH/ORP Sensor electronics for connection to a PLC or to the Signet 8900 or 9900 instruments	
	3 KΩ Balco versions	compatible with the Signet 2760 pH/ORP preamplifier for connection to the Signet 8750 pH/ORP Transmitter	
Process Connection			
	¾ in. NPT	ISO 7/1-R 3/4	Mounts into Signet fittings
Wetted Materials			
	pH	Ryton® (PPS), glass, UHMW PE, FPM	
	ORP	Ryton® (PPS), glass, UHMW PE, FPM, Platinum	
Max. Temperature/Pressure Rating			
Operating Temperature Range*		-10 °C to 85 °C	14 °F to 185 °F
Operating Pressure Range		6.8 bar @ -10 to 65 °C (100 psi @ 14 to 150 °F)	
		4 bar @ 65 to 85 °C (58 psi @ 150 to 185 °F)	
*Best performance for 2726-HF sensors is above 10 °C (50 °F)			
Recommended Storage Temperature			
		0 °C to 50 °C	32 °F to 122 °F
The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)			
The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)			
Mounting			
In-line Mounting	Use the sensor threads		
	Use a Signet standard fitting up to 4 in.		
	Sensor can be mounted at any angle		
Submersible Mounting	Use threads on models 2750 or 2760		
	Requires ¾ inch NPT or ISO 7/1-R 3/4 male threaded liquid tight extension conduit.		
Shipping Weight			
	0.25 kg	0.55 lb	
Standards and Approvals			
	Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety		

See Temperature and Pressure graphs for more information

Dimensions



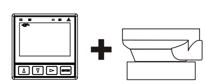
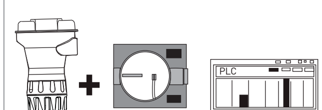


Mounting Angle

Models 2724-2726 may be mounted at any angle without affecting the performance.

*Avoid locations with air pockets and sediment.

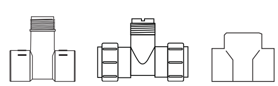
System Overview

Panel Mount	Field Mount - Pipe, Tank, Wall	4 to 20 mA Input
Signet Instruments 8750 with 2760 Preamplifier 8900 9900 with 2750 Electronics	Signet Instruments 9900 with 2750 Electronics and 3-8050 Universal Mount kit	3-2750 Sensor Electronics and customer supplied Chart Recorder or Programmable Logic Controller
		

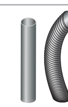
Signet 2724-2726
DryLoc® pH/ORP Electrodes

All sold separately

In-Line Installation -
Signet and threaded fittings only



Submersible Installation -
Customer supplied pipe extension
or conduit with 3/4 in. NPT or
ISO 7/1-R 3/4 threads*



*Refer to the Signet Submersion brochure located in the K-Factors Fittings and More Kit (3-0000-709) for installation suggestions and options.

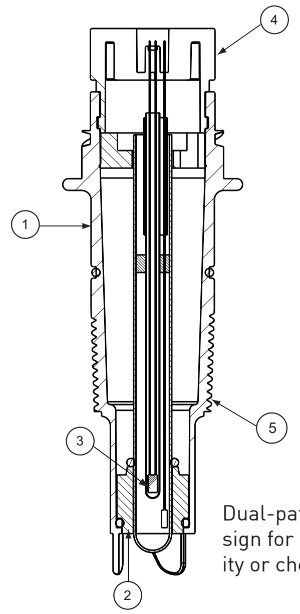
Electrode Key Features and Benefits:

1. Ryton® body for chemical compatibility with most harsh chemicals.
2. Porous UHMW PE (ultra high molecular weight polyethylene) junction resists fouling and build-up.
3. Internal temperature sensor located in the glass stem for a quick temperature response.
4. DryLoc® connector with corrosion resistant gold pins for quick and easy sensor removal.
   - Resists moisture and dirt intrusion.
5. Dual-patented reference design with a 406 mm
   - (16 inch) reference pathway enhances longer life. This enables the sensor to last significantly longer than other standard pH/ ORP electrodes in most applications.

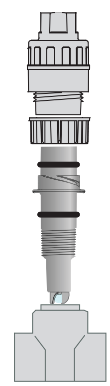
5a. With the new patented reference design, the Signet 2726-LC version performs better in low conductivity water between 20 - 100 µS and lasts longer than previous "DI" electrodes.

5b. The 2726-LC sensor also performs in applications with extremely low (less than 20 µS) conductivity. Special precautions must be taken to avoid measurement complications.
Please note the following.
   - Electrostatic charges (streaming potentials) can cause dramatic offsets in a system with very low conductivity water. To minimize this, sensors should be placed in a well grounded system.
   - To enhance performance, a low flow cell is recommended to provide a steady flow rate (150 ml/minute). Sensors placed in high flow applications will experience noisier readings due to streaming potential.

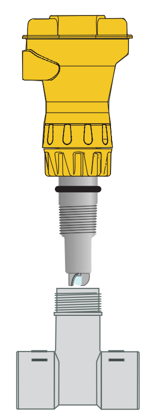
6. Threads for NPT or ISO process connection into reducing tees
   - Use off-the-shelf GF reducing tees DN20 to DN100 (¾ to 4 in.).
7. Mounts directly into Signet fittings (½ in. 4 in.) for easy sensor retrofitting.
8. Mount submersed into a tank via the 2750 or 2760 back threads.



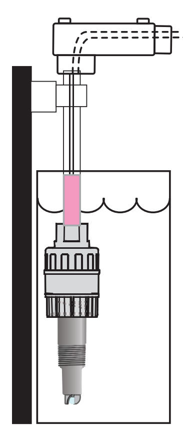
Dual-patented reference design for long life in conductivity or chemicals.



6 Sensor in threaded reducing tee



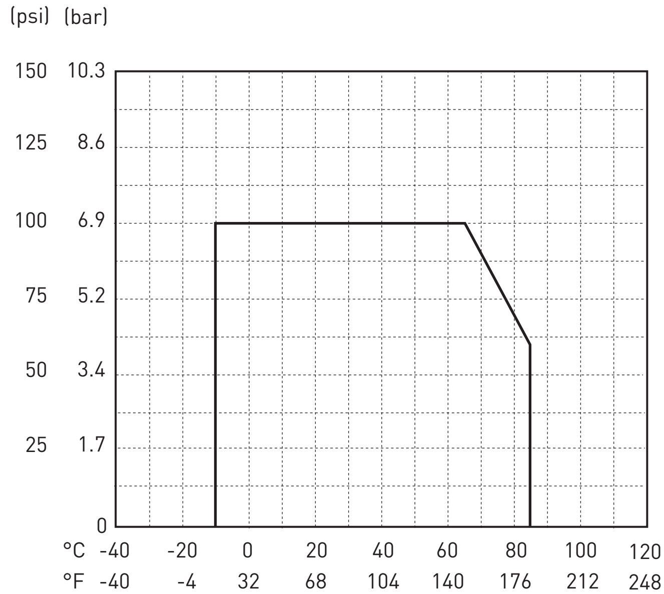
7 Sensor in Signet fitting



8 Sensor submersible installation

Operating Temperature/Pressure Graph

Note:
The pressure/temperature graphs are specifically for the Signet sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Application Tips
- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals.
- Use bulb protected electrodes for general purpose applications
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

Model 2724-2726 Ordering Notes
1) pH and ORP electrodes require connection to model 2750 sensor electronics or 2760 preamplifier.
2) The 2750 "EasyCal" feature recognizes common pH and ORP buffer values of 4, 7 and 10 pH and +87 and +264 mV for ORP.

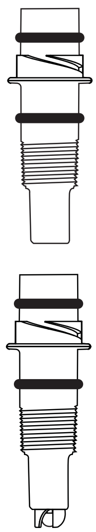
Buffer Solutions
3822-7004
3822-7007
3822-7010

Quinhydrone
3822-7115

The Signet pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.

All pH buffers are color coded for easy identification; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue. All pH buffers are traceable to NIST standards. These buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone.

Ordering Information



Mfr. Part No.	Code	Tip design	Process Connection Thread Options
pH Electrodes			
Temperature element PT1000; use with 2750 sensor electronics*			
3-2724-00	**159 001 545**	Flat	¾ in. MNPT, Thread
3-2724-01	**159 001 546**	Flat	ISO 7/1-R 3/4 Thread
3-2726-00	**159 001 553**	Bulb	¾ in. MNPT, Thread
3-2726-01	**159 001 554**	Bulb	ISO 7/1-R 3/4 Thread
3-2726-HF-00	**159 001 549**	Bulb, HF resistant[1]	¾ in. MNPT, Thread
3-2726-HF-01	**159 001 550**	Bulb, HF resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-LC-00	**159 001 557**	Bulb, Low Conductivity[2]	¾ in. MNPT, Thread
3-2726-LC-01	**159 001 558**	Bulb, Low Conductivity[2]	ISO 7/1-R 3/4 Thread
Temperature element 3 KΩ Balco; use with 2760 preamplifier**			
3-2724-10	**159 001 547**	Flat	¾ in. MNPT, Thread
3-2724-11	**159 001 548**	Flat	ISO 7/1-R 3/4 Thread
3-2726-10	**159 001 555**	Bulb	¾ in. MNPT, Thread
3-2726-11	**159 001 556**	Bulb	ISO 7/1-R 3/4 Thread
3-2726-HF-10	**159 001 551**	Bulb HF resistant[1]	¾ in. MNPT, Thread
3-2726-HF-11	**159 001 552**	Bulb HF resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-LC-10	**159 001 559**	Bulb, Low Conductivity[2]	¾ in. MNPT, Thread
3-2726-LC-11	**159 001 560**	Bulb, Low Conductivity[2]	ISO 7/1-R 3/4 Thread
ORP Electrodes; Compatible with both the 2750 sensor electronics and the 2760 preamplifier			
3-2725-60	**159 001 561**	Flat	¾ in. MNPT, Thread
3-2725-61	**159 001 562**	Flat	ISO 7/1-R 3/4 Thread

*The 2750 sensor electronics has a digital (S^3L) output which is used with 8900 or 9900 Instruments. It also has a 4 to 20 mA output for connections to PLC's, data recorders, etc.

**The 2760 preamplifier is used for connection directly to Signet 8750 Transmitter or other analog transmitters.

[1]HF resistant ≤2% HF

[2]Low conductivity applications, 20 - 100 µS/cm recommended

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
1220-0021	**198 801 000**	O-ring, FPM
3-2700.395	**159 001 605**	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 DryLoc® Adapter Cable (for use with 2750 and 2760)
3-0700.390	**198 864 403**	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10.00 buffer solution, 1 pint (473 ml) bottle

3-2724.099 Rev C (5/13)

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efectorsoo

Pressure sensors

PN2222

Combined pressure sensor
PN22

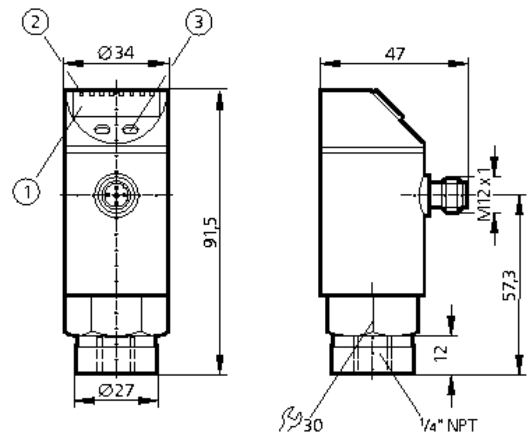
Process connection: ¼" NPT

Zero and span adjustable
Function programmable

2 outputs OUT1 = switching output OUT2 = switching output or analog output

4-digit alphanumeric display

Measuring range
0...1450 PSI
0..100 bar
0...10 MPa



1: 4-digit alphanumeric display 2: LEDs (display unit / switching status) 3: Programming button

Application	**Type of pressure: relative pressure Liquids and gases For gaseous media the application is limited to max. 363 PSI (25 bar)**
Electrical design	**DC PNP / DC NPN**
Output	**2 x normally open / closed programmable or 1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V; programmable 1:4)**

Operating voltage [V]	20...30 DC ¹)
Current rating [mA]	2 x 250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 65

Analog output	4...20 mA / 0...10 V		
Load for analog output [ohms]	4...20 mA: max. (Ub - 10 V) x 50 / 0...10 V: min. 2000		
Permissible overl. pressure	4350 PSI	300 bar	30 MPa
Bursting pressure min.	9400 PSI	650 bar	65 MPa
Setting range			
Switch-on point, SP	12...1450 PSI	0.8...100.0 bar	0.08...10.00 MPa
Switch-off point, rP	6...1444 PSI	0.4...99.6 bar	0.04...9.96 MPa
Analog output/lower end, ASP	0...580 PSI	0.0...40.0 bar	0.00...4.00 MPa
Analog output/upper end, AEP	364...1450 PSI	25.0...100.0 bar	2.50...10.00 MPa
in steps of	2 PSI	0.2 bar	0.02 MPa
Programming options	hysteresis / window function; N.O. / N.C; output polarity; current / voltage outputs; damping; calibration of displayed values; display can be rotated / deactivated; display unit		

Accuracy / deviations (in % of the span)	
Turn down 1:1	
Accuracy of switch point	
Characteristics deviation *)	
Linearity	< ± 0.5
Hysteresis	< ± 0.6
Repeatability **)	< ± 0.5
Long-term stability ***)	< ± 0.1
Temperature coefficients	< ± 0.1

(TEMPCO) in the temperature range 0...80 °C (in% of the span per 10 K)	< ± 0.1
- greatest TEMPCO of the zero point	< ± 0.1
- greatest TEMPCO of the span	< ± 0.2
Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Damping for the switching output (dAP) [ms]	0; 10; 20;...100; 200;...4000
Switching frequency [Hz]	170...0.125
Response time analog output [ms]	3
Damping for the analog output (dAA) [ms]	0; 100; 500; 2000

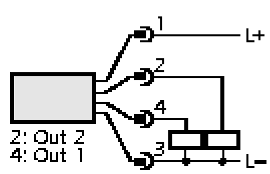
PN2222

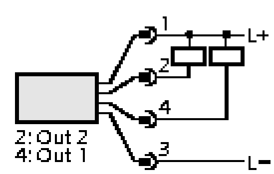
Operating temperature [°C]	-25...80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
Protection	IP 67 (IEC 60529) / (UL50), III (EN 50178)
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 0.5/1 kV EN 61000-4-6 HF conducted: 10 V
Housing material	stainless steel (304S15); stainless steel (316S12); PC (Macrolon); PBT (Pocan); PEI; FPM (Viton); EPDM/X (Santoprene)
Materials (wetted parts)	stainless steel (303S22); ceramics; FPM (Viton)
Function display Switching status LED Power LED System pressure, function LED	 2 x yellow 3 x green (display unit) 4-digit alphanumeric display
Connection	M12 connector; gold-plated contacts

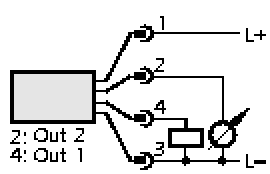
Wiring

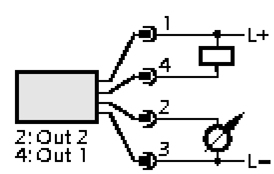
Programming of the output function
(OUT1 / OUT2):
Hno = hysteresis / normally open
Hnc = hysteresis / normally closed
Fno = window function / normally open
Fnc = window function / normally closed
Complementary outputs:
output 1: = Hno, output 2: = Hnc
(with the same SP / rP)

Programming of the analog output (OUT2):
I = current output (4...20 mA)
U = voltage output (0...10 V)









Remarks	1) to EN50178, SELV, PELV; referring to UL: “limited voltage” with overcurrent protection in accordance with UL508 *) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086) **) with temperature fluctuations < 10 K ***) in % of the span per year

efectorsoo

ifm electronic

Pressure sensors

PN2228

Combined pressure sensor
PN22

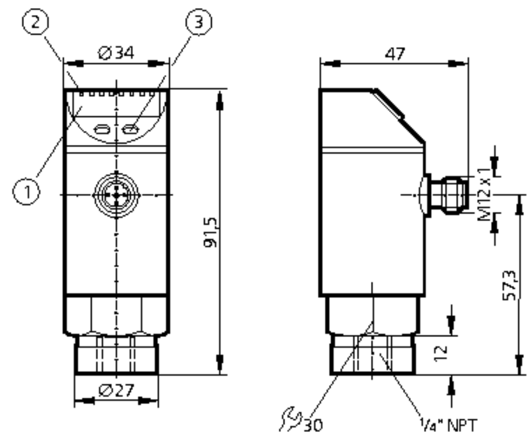
Process connection: ¼" NPT

Display units:
mbar, kPa, inH2O, mmWS
Zero and span adjustable
Function programmable

2 outputs OUT1 = switching output OUT2 = switching output or analog output

4-digit alphanumeric display

Measuring range
-5.0...100.4 inH2O



1: 4-digit alphanumeric display 2: LEDs (display unit / switching status) 3: Programming button

Application	**Type of pressure: relative pressure Liquids and gases**
Electrical design	**DC PNP / DC NPN**
Output	**2 x normally open / closed programmable or 1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V; programmable 1:4)**

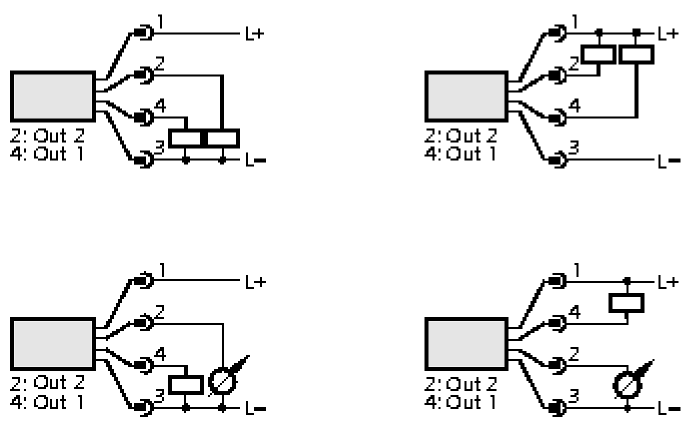
Operating voltage [V]	20...30 DC ¹)
Current rating [mA]	2 x 250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 65

Analog output	4...20 mA / 0...10 V
Load for analog output [ohms]	4...20 mA: max. (Ub - 10 V) x 50 / 0...10 V: min. 2000
Permissible overl. pressure [inH2O]	4000
Bursting pressure min. [inH2O]	12000
Setting range	
Switch-on point, SP [inH2O]	-4.2...100.4
Switch-off point, rP [inH2O]	-4.6...100.0
Analog output/lower end, ASP [inH2O]	-5.0...40.2
Analog output/upper end, AEP [inH2O]	20.0...100.4
in steps of [inH2O]	0.2
Programming options	hysteresis / window function; N.O. / N.C; output polarity; current / voltage outputs; damping; calibration of displayed values; display can be rotated / deactivated; display unit

Accuracy / deviations (in % of the span)	
Turn down 1:1	
Accuracy of switch point	
Characteristics deviation *)	
Linearity	< ± 0.5
Hysteresis	< ± 0.6
Repeatability **)	< ± 0.5

Long-term stability ***)	< ± 0.1
Temperature coefficients (TEMPCO) in the temperature range 0...80 °C (in% of the span per 10 K)	< ± 0.1 < ± 0.1
- greatest TEMPCO of the zero point	< ± 0.2
- greatest TEMPCO of the span	< ± 0.2
Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Damping for the switching output (dAP) [ms]	0; 10; 20;...100; 200;...4000
Switching frequency [Hz]	170...0.125
Response time analog output [ms]	3
Damping for the analog output (dAA) [ms]	0; 100; 500; 2000

PN2228

Operating temperature [°C]	-25...80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
Protection	IP 65 (IEC 60529) / (UL50), III (EN 50178)
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 0.5/1 kV EN 61000-4-6 HF conducted: 10 V
Housing material	stainless steel (304S15); stainless steel (316S12); PC (Macrolon); PBT (Pocan); PEI; FPM (Viton); EPDM/X (Santoprene); PTFE
Materials (wetted parts)	stainless steel (303S22); ceramics; FPM (Viton)
Function display Switching status LED Power LED System pressure, function LED	 2 x yellow 4 x green (display unit) 4-digit alphanumeric display
Connection	M12 connector; gold-plated contacts
Wiring Programming of the output function (OUT1 / OUT2): Hno = hysteresis / normally open Hnc = hysteresis / normally closed Fno = window function / normally open Fnc = window function / normally closed Complementary outputs: output 1: = Hno, output 2: = Hnc (with the same SP / rP) Programming of the analog output (OUT2): I = current output (4...20 mA) U = voltage output (0...10 V) 	
Remarks	¹) to EN50178, SELV, PELV; referring to UL: “limited voltage” with overcurrent protection in accordance with UL508 *) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086) **) with temperature fluctuations < 10 K ***) in % of the span per year

efector600

ifm electronic

Temperature sensors

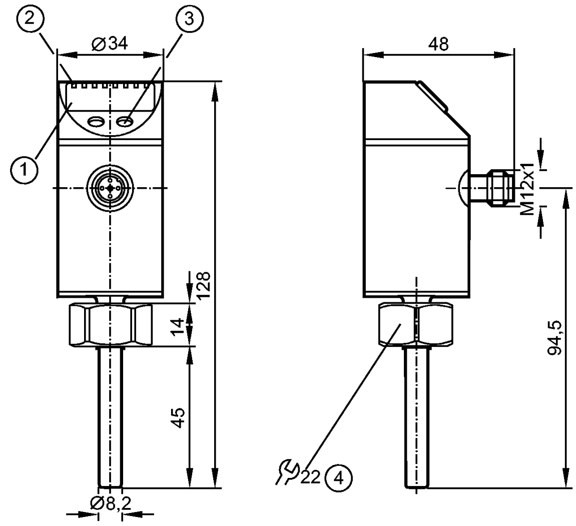
TN2531

Electronic temperature sensor
TN

Compact type for adapter
Quick disconnect
Process connection:
internal thread M18 x 1.5 for adapter

Communication interface: IO-Link 1.0
(COM2 slave, 38.4 kBaud)

Switching output, analog output 4...20 mA or 0...10 V
4-digit alphanumeric display
Measuring range
-40...150 °C / -40...302 °F



1: 4-digit alphanumeric display
2: LEDs
3: Programming button
4: internal thread M18 x 1.5

Made in Germany

CE c UL us LISTED

Application	**liquids and gases**
Electrical design	**DC PNP/NPN**
Output	**1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V, scalable)**
Probe length L [mm]	**45**
Operating voltage [V]	18...32 DC
Current rating [mA]	250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
Overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 50
Analog output	4...20 mA / 0...10 V
Pressure rating [bar]	300
Setting range	
Analog start point, ASP [°C/°F]	-40.0...145.0 / -40.0...293.0
Analog end point, AEP [°C/°F]	-35; 0...150; 0 / -31; 0...302; 0
Set point, SP [°C/°F]	-39.5...150.0 / -39.0...302.0
Reset point, rP [°C/°F]	-40.0...149.5 / -40.0...301.0
in steps of [°C/°F]	0.1 / 0.1
Adjustment of the switch point	Programming button
Accuracy	
Switching output [K]	± 0.3
Analog output [K]	± 0.3
Display [K]	± 0.3
Resolution	
Switching output [K]	0.1
Analog output [K]	< 0.1
Display [K]	0.1
Temperature drift (/ 10 K)	0.1
Power-on delay time [s]	1

TN2531

Measuring / display cycle [ms]	[ms]	200
Measuring element		1 x Pt 1000, to DIN EN 60751, class B
Dynamic response	T05 / T09 [s]	1 / 3 *)
Minimum installation depth	[mm]	12

efector600

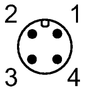
ifm electronic

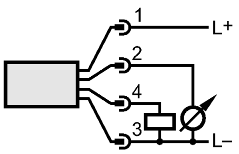
TN2531

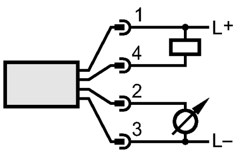
Ambient temperature	[°C]	-25...70
Storage temperature	[°C]	-40...100
Protection		IP 67, III
Insulation resistance	[MΩ]	> 100 / 500 V DC
Shock resistance		DIN IEC 68-2-27:50 g (11 ms)
Vibration resistance		DIN EN 60068-2-6:20 g (10...2000 Hz)
EMC		EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 1 kV EN 61000-4-6 HF conducted: 10 V
Housing materials		stainless steel (304S15); PBT (Pocan); PC (Makrolon); EPDM/X (Santoprene); FPM (Viton)
Materials (wetted parts)		stainless steel 316L / 1.4404
Display		Display unit 2 x LED green Switching status LED yellow Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display
Connection		M12 connector; gold-plated contacts
Weight	[kg]	0.19
Remarks		cULus - Class 2 source required *) according to DIN EN 60751 The values for accuracy apply to flowing water. load for current output: Rmax [Ω]: (Ub - 10 V) x 50 / for voltage output: Rmin [Ω]: 2000

Wiring

Programming of the output function:
Hno = hysteresis / N.O.
Hnc = hysteresis / N.C.
Fno = window function / N.O.
Fnc = window function / N.C.







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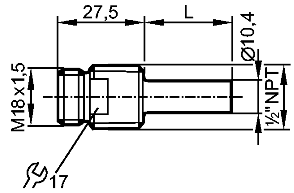
ifm electronic

Accessories

UT0028

½" NPT

Thermowell for temperature sensors



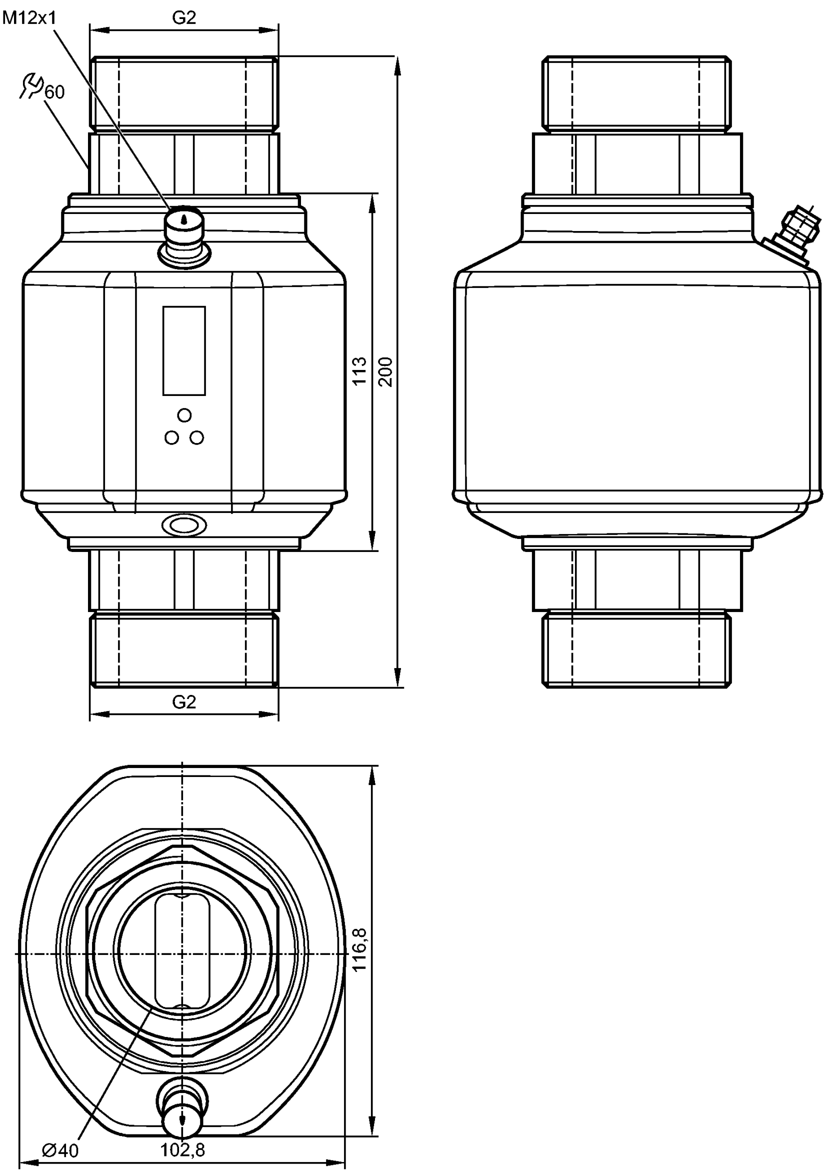
Probe length L [mm]	27
Design	for types TN
Pressure rating [bar]	16
Inside diameter [mm]	8.4
Process connection	½" NPT
Housing materials	stainless steel (316)
Accessories (optional)	heat conductive paste order no. 700692

efector300®

SM2004

SMR21XGX50KG/US

Flow sensors



Made in Germany

CE cULus LISTED IO-Link

Product characteristics

Magnetic-inductive flow meter
Quick disconnect
Process connection: G2 flat seal
connection to pipe by means of an adapter
Empty pipe detection
2 outputs
OUT1 = analogue signal temperature OUT2 = analogue signal flow
4-digit alphanumeric display
Display units: l/min, m³/h, gpm, gph, °C, °F
Measuring range
5...600 l/min (1.3...158.5 gpm)
-20...80 °C (-4...176 °F)

Application

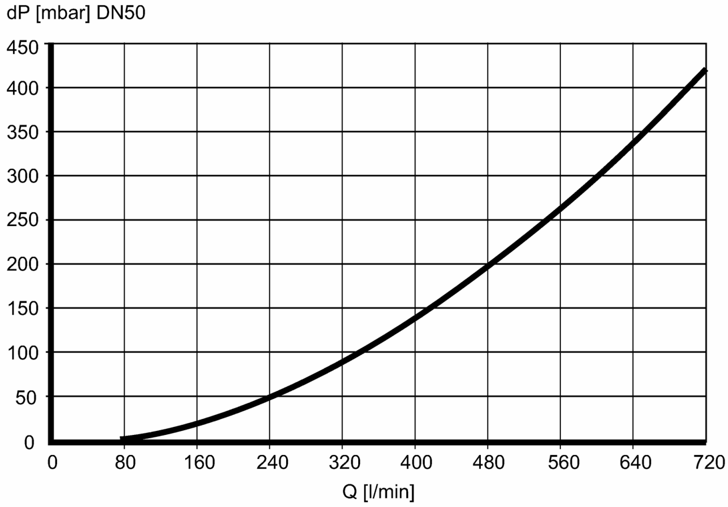
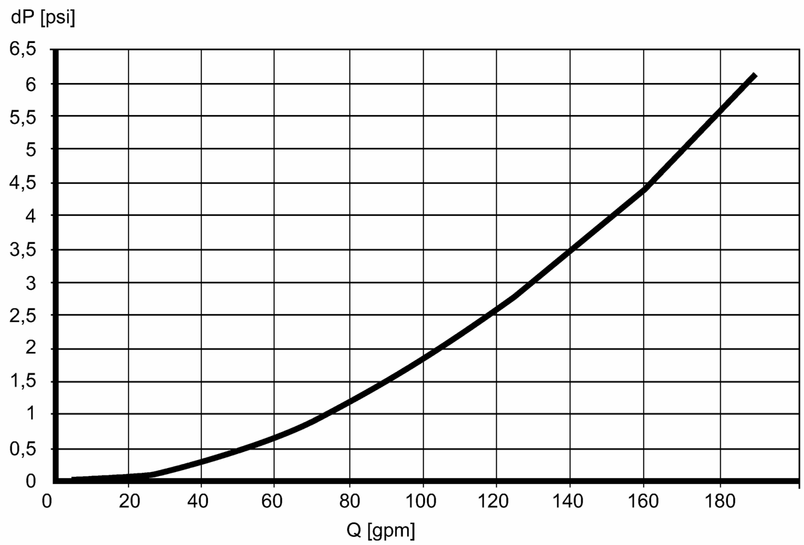
efector300

SM2004

SMR21XGX50KG/US

Flow sensors

Application	Conductive liquids (conductivity:>= 20 µS/cm / viscosity: < 70 cSt at 104 °F)			
Medium temperature [°C / °F]	-10...70 / 14...158			
Electrical data				
Electrical design	DC			
Operating voltage [V]	18...32 DC [1])			
Current consumption [mA]	< 150			
Insulation resistance [MΩ]	> 100 (500 V DC)			
Protection class	III			
Reverse polarity protection	yes			
Outputs				
Output function	OUT1: analog (4…20 mA) oder IO-Link [2]) OUT2: analog (4…20 mA)			
Analog output	4...20 mA; ≤ 22 mA			
Max. load [Ω]	500			
Measuring / setting range				
Flow monitoring				
Measuring range	5...600 l/min	0.3...36 m³/h	80...9510 gph	1.3...158.5 gpm
Display range	-720...720 l/min	-43.2...43.2 m³/h	-11410...11410 gph	-190.2...190.2 gpm
Resolution	0.5 l/min	0.02 m³/h	5 gph	0.1 gpm
Analog start point, ASP	0...480 l/min	0...28.8 m³/h	0...7610 gph	0...126.8 gpm
Analog end point, AEP	120...600 l/min	7.2...36 m³/h	1900...9510 gph	31.7...158.5 gpm
Low flow cut-off, LFC	5...15 l/min; 0.3...0.9 m³/h; 80...240 gph; 1.3…4 gpm			
in steps of	0.5 l/min	0.02 m³/h	5 gph	0.1 gpm
Measuring dynamics	1:120			
Temperature monitoring				
Measuring range [°C / °F]	-20...80 / -4...176			
Display range [°C / °F]	-40...100 / -40...212			
Resolution [°C / °F]	0.2 / 0.5			
Analog start point, ASP [°C / °F]	-20...60 / -4...140			
Analog end point, AEP [°C / °F]	0...80 / 32...176			
in steps of [°C / °F]	0.2 / 0.5			
Accuracy / deviations				
Flow monitoring				
Accuracy [% of the final value]	± (0.8% MW + 0.5% MEW) [3])			
Repeatability	± 0.2% MEW			

Pressure loss (dP) / flow rate (Q)	 

Temperature monitoring		
Accuracy	[K]	± 1 (25 °C; Q > 15 l/min) / ± 1 (77 °F; Q > 4 gpm)
Reaction times		
Power-on delay time	[s]	5
Flow monitoring		
Response time	[s]	< 0.25 (dAP = 0)
Damping, dAP	[s]	0...5
Temperature monitoring		
Response time	[s]	T09 = 3 (Q > 15 l/min) / T09 = 3 (Q > 4 gpm)
Software / programming		
Programming options		Display abschaltbar; Anzeigeeinheit; Leerrohr-Erkennung
Interfaces		
IO-Link Device		
Transfer type		COM2 (38.4 kBaud)
IO-Link revision		1.1
SDCI standard		IEC 61131-9 FDIS
IO-Link Device ID		379 d / 00 01 7B h
Profiles		Smart Sensor: Process Data Variable; Device Identification
SIO mode		no

efector300

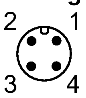
SM2004

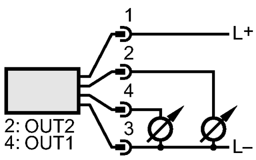
SMR21XGX50KG/US

Flow sensors

Required master port class		A
Process data analogue		3
Process data binary		2
Min. process cycle time	[ms]	5
Environment		
Pressure rating	[psi]	232
Ambient temperature	[°C / °F]	-10...60 / 14...140
Storage temperature	[°C / °F]	-25...80 / -13...176
Protection		IP 65 / IP 67
Tests / approvals		
EC pressure equipment directive 97/23/EC		article 3, paragraph (3) - sound engineering practice
EMC		DIN EN 60947-5-9
Shock resistance		DIN EN 60068-2-27: 20 g (11 ms)
Vibration resistance		DIN EN 60068-2-6: 5 g (10...2000 Hz)
Mechanical data		
Process connection		G2 flat seal
Materials (wetted parts)		stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PEEK (polyether ether ketone); Hastelloy C-4 (2.4610); Centellen; FKM
Housing materials		stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PC (polycarbonate); FKM; PBT-GF 20; elastolan
Weight	[kg]	3.065
Displays / operating elements		
Display		Display unit 6 x LED green (l/min, m^3/h, gpm, gph, °C, °F) Function display 1 x LED yellow (10^3) Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display
Electrical connection		
Connection		M12 connector; gold-plated contacts

Wiring





Pin 2: Flow monitoring
Pin 4: Temperature monitoring
Pin 4: IO-Link [2])

Accessories		
Accessories (included)		2 x packing washer (Centellen); Label
Remarks		
Remarks		[1]) to DIN EN 50178, SELV, PELV [2]) IO-Link communication must be activated in the menu. [3]) Q > 15l/min, medium and ambient temperature +22 °C ± 4K (+72 °F ± 7 °F) MW = measured value MEW = final value of the measuring range

SM2004

SMR21XGX50KG/US

Flow sensors

Pack quantity	[piece]	1

Other data

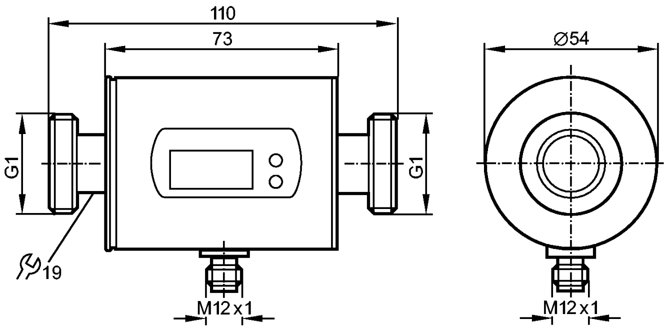
Temperature drift	± 0.0333 °C / K; ± 0.0599 °F / K

efector300

SM0504

SMR11GGX50KG/US100

Flow sensors



Made in Germany

CE

Product characteristics
Magnetic-inductive flow meter
Quick disconnect
Process connection: G1 flat seal
2 outputs
OUT1 = analogue signal temperature OUT2 = analogue signal flow
Display units:
l/min, m³/h, gpm, gph
°C / °F
connection to pipe by means of an adapter

Application		
Application		Conductive liquids (conductivity:>= 20 µS/cm / viscosity: < 70 cSt at 104 °F)
Medium temperature	[°F]	14...158

Electrical data		
Electrical design		DC
Operating voltage	[V]	20...30 DC ¹)
Current consumption	[mA]	120 (24 V)
Insulation resistance	[MΩ]	> 100 (500 V DC)
Protection class		III
Reverse polarity protection		yes

Outputs		
Output function		2 x analog (4...20 mA scalable)
Overload protection		yes
Analog output		4...20 mA, max. 22 mA
Max. load	[Ω]	max. 500

Measuring / setting range		
Flow monitoring		
Measuring range	0.10...30.00 gpm	6...1800 gph
Display range	-31.70...31.70 gpm	-1902...1902 gph
Resolution	0.05 gpm	2 gph
Analog start point, ASP	0.00...21.15 gpm	0...1268 gph
Analog end point, AEP	5.30...30.00 gpm	318...1800 gph
in steps of	0.05 gpm	2 gph
Temperature monitoring		

efector300

SM0504

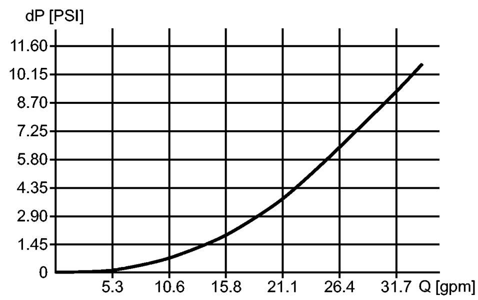
SMR11GGX50KG/US100

Flow sensors

Measuring range	[°F]	-4...176
Resolution	[°F]	0.5
Analog start point, ASP	[°F]	-4.0...140.5
Analog end point, AEP	[°F]	31.5...176.0
in steps of	[°F]	0.5

Accuracy / deviations

Flow monitoring

Accuracy	[% of the final value]	± (2% MW + 0.5% MEW)
Repeatability		± 0.2% MEW
Pressure loss (dP) / flow rate (Q)		

Temperature monitoring

Accuracy	[K]	± 4.5 (Q > 0.26 gpm)

Reaction times

Power-on delay time	[s]	5
Flow monitoring		
Response time	[s]	< 0.150 (dAP = 0)
Damping, dAP	[s]	0.0...5.0
Temperature monitoring		
Response time	[s]	T09 = 30 (Q > 0.26 gpm)

Environment

Pressure rating	[psi]	232
Ambient temperature	[°F]	14...140
Storage temperature	[°F]	-13...176
Protection		IP 67

Tests / approvals

EMC	EN 61000-4-2 ESD:	4 kV CD / 8 kV AD
	EN 61000-4-3 HF radiated:	10 V/m
	EN 61000-4-4 Burst:	2 kV
	EN 61000-4-5 Surge:	0.5 kV
	EN 61000-4-6 HF conducted:	10 V
Shock resistance	DIN IEC 68-2-27:	20 g (11 ms)
Vibration resistance	DIN IEC 68-2-6:	5 g (10...2000 Hz)
MTTF [Years]		175

Mechanical data

Process connection		G1 flat seal
Materials (wetted parts)		stainless steel 316L / 1.4404; PEEK (polyether ether ketone); FKM
Housing materials		stainless steel 316L / 1.4404; PBT-GF 20; PC (Makrolon); EPDM/X (Santoprene)
Weight	[kg]	0.593

Displays / operating elements

efector300®

SM0504

SMR11GGX50KG/US100

Flow sensors

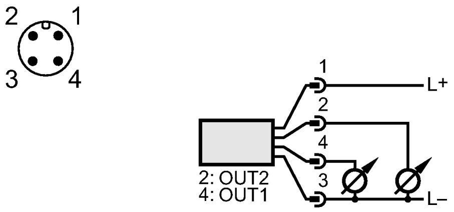
Display	Display unit 6 x LED green (l/min, m³/h, gpm, gph, °C, °F) Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display

Electrical connection

Connection	M12 connector; gold-plated contacts

Wiring

OUT1 = analogue signal temperature
OUT2 = analogue signal flow



Remarks

Remarks	[1]) to EN50178, SELV, PELV MW = measured value MEW = final value of the measuring range
Pack quantity [piece]	1

SDL Project - System Valves Totals									
Valve #	Type of Action	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
2	Pneumatic Spring Return	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
18	Pneumatic Spring Return	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
3	Pneumatic Spring Return	40	1-1/2"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
2	Pneumatic Spring Return	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
1	Flow Control Valve	50	2"	316 SS	3 pc SW	V320SSFFFA50	ALF30-SR	V100E	FloTite/Alpha/BLX
2	Flow Control Valve	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
4	Swing Check Valve	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
1	Swing Check Valve	40	1-1/2"	CPVC	3 pc SW	TC 2150ST	None	None	Hayward
6	Manual Ball Valve	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
8	Manual Ball Valve	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
26	Manual Ball Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
5	Manual Ball Valve	25	1"	CPVC	1 pc SW	TB2200ST	None	None	Hayward
1	Manual Globe Valve	40	1-1/2"	316 SS	NPT	GB-200	None	None	JFW VALVE
51	Valve Totals								
Note: Does not include off-skid equipment.									

SDL Project - Valves List										
Stage-1 VSEP RO Skid										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-100	Pneumatic Spring Return	Hot Water Inlet to Bag Filter	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
XV-101	Pneumatic Spring Return	Feed Inlet to Bag Filter	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
XV-102	Pneumatic Spring Return	Feed to Header	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-105	Pneumatic Spring Return	Permeate to VSEP Feed Tank, T-110	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-106	Pneumatic Spring Return	Permeate to Tank, T-130	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-107	Pneumatic Spring Return	Concentrate to VSEP Feed Tank, T-110	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-108	Pneumatic Spring Return	Concentrate to Reject Tank, T-120	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-110	Pneumatic Spring Return	CIP Feed to VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-111	Pneumatic Spring Return	CIP Permeate From VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-112	Pneumatic Spring Return	Permeate From VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-113	Pneumatic Spring Return	CIP Concentrate From VSEP #1	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
XV-114	Pneumatic Spring Return	Concentrate From VSEP #1	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
FCV-110	Flow Control Valve	Feed to VSEP #1	50	2"	316 SS	3 pc SW	V320SSFFFA50	ALF30-SR	V100E	FloTite/Alpha/BLX
FCV-112	Flow Control Valve	Concentrate from VSEP #1	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
CV-110	Swing Check Valve	Permeate Return #1	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
MV-100	Manual Ball Valve	Bag Filter #100 Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-101	Manual Ball Valve	Bag Filter #101 Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-103	Manual Ball Valve	Bag Filter #100 Outlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-104	Manual Ball Valve	Bag Filter #101 Outlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-106	Manual Ball Valve	Feed Pump, P-100/101Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-109	Manual Ball Valve	Bag Filter #100 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1010	Manual Ball Valve	Bag Filter #101 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1012	Manual Ball Valve	Bag Filter, BF-100 Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1013	Manual Ball Valve	Bag Filter, BF-101 Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1015	Manual Ball Valve	Feed Pump, P-100-101 Inlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1018	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1019	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-170	Manual Ball Valve	Feed #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-171	Manual Ball Valve	Permeate #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-172	Manual Ball Valve	Concentrate #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
			Qty							
	Isolation Manual Ball Valve	Instruments-PIT	4	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PDT	2	1/4"	316 SS	NPT	T80SS	None	None	FloTite
Stage 2 - Spiral RO Skid										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-200	Pneumatic Spring Return	Hot water in	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
XV-201	Pneumatic Spring Return	Feed to Spiral from feed tank	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
XV-202	Pneumatic Spring Return	Feed Pump, P-201 Outlet	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-203	Pneumatic Spring Return	Feed In from CIP Skid	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-205	Pneumatic Spring Return	Spiral Permeate out to CIP Skid	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-206	Pneumatic Spring Return	Spiral Permeate to Destination, T-300	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-207	Pneumatic Spring Return	Spiral Permeate to Feed Tank, T-200/210	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-204	Pneumatic Spring Return	Spiral Concentrate out to CIP Skid	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
XV-208	Pneumatic Spring Return	Spiral Concentrate to Reject Tank, T-120	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
FCV-200	Flow Control Valve	Concentrate from Spiral	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
CV-201	Swing Check Valve	Permeate from Spiral RO	40	1.5"	CPVC	3 pc SW	TC 2150ST	None	None	Hayward
MV-200	Manual Ball Valve	Feed Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite

MV-201	Manual Ball Valve	Bag Filter, BF-200 Inlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-202	Manual Ball Valve	Bag Filter, BF-201 Inlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-203	Manual Ball Valve	Bag Filter, BF-200 Outlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-204	Manual Ball Valve	Bag Filter, BF-201 Outlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-205	Manual Ball Valve	Bag Filter Drain	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-208	Manual Globe Valve	Permeate from stage-1	40	1-1/2"	316 SS		GB-200	None	None	JFW VALVE
MV-2010	Manual Ball Valve	Bag Filter #200 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2011	Manual Ball Valve	Bag Filter #201 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2017	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2018	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PIT	3	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PDT	2	1/4"	316 SS	NPT	T80SS	None	None	FloTite
CIP Skid										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-190	Pneumatic Spring Return	Hot Water to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-191	Pneumatic Spring Return	Hot Water to VSEP	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-192	Pneumatic Spring Return	CIP Tank to Drain	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-193	Pneumatic Spring Return	CIP Tank to Pump	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-194	Pneumatic Spring Return	CIP Pump to Feed Header	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-195	Pneumatic Spring Return	Feed Bypass to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-196	Pneumatic Spring Return	Permeate to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-197	Pneumatic Spring Return	Permeate to Destination	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-198	Pneumatic Spring Return	Concentrate to CIP Tank	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
XV-199	Pneumatic Spring Return	Concentrate to Destination	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
CV-190	Swing Check Valve	Hot Water In	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
CV-191	Swing Check Valve	Bag Filter Inlet	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
CV-192	Swing Check Valve	Bag Filter Inlet	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
MV-190	Manual Ball Valve	Bag Filter Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-191	Manual Ball Valve	Bag Filter Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-192	Manual Ball Valve	Feed Pump Inlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-193	Manual Ball Valve	Pump Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-194	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-195	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-196	Manual Ball Valve	IC Feed Sample Port	8	1/4"	317 SS	NPT	T80SS	None	None	FloTite
MV-197	Manual Ball Valve	IC Permeate Sample Port	8	1/4"	318 SS	NPT	T80SS	None	None	FloTite
MV-198	Manual Ball Valve	IC Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
Off-Skid Valves (provided by others)										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-210	Pneumatic Spring Return	Tank T-200 to Spiral Skid	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-211	Pneumatic Spring Return	Tank T-210 to Spiral Skid	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-300	Pneumatic Spring Return	Spiral Permeate to Hot Water Tank	51	2"	CPVC	4 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-301	Pneumatic Spring Return	Spiral Permeate to Discharge	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA

SDL Project - Valves Calculations

Stage-1 VSEP RO Skid													
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
Modulated Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
FCV-110	Feed to VSEP #1	50	2"	2.066	3.351	15.0	30.0	37.5	500	1.34	1.68	3.59	1.09
FCV-112	Concentrate from VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	500	0.89	1.12	9.29	2.83
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
On/Off Pneumatic Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-100	Hot Water Inlet to Bag Filter	63	2.5"	4.000	12.560	30.0	60.0	75.0	5	26.83	33.54	1.92	0.58
XV-101	Feed Inlet to Bag Filter	63	2.5"	4.000	12.560	17.5	35.0	43.8	5	15.65	19.57	1.12	0.34
XV-102	Feed to Header	50	2"	2.583	5.237	17.5	35.0	43.8	5	15.65	19.57	2.68	0.82
XV-105	Permeate to VSEP Feed Tank, T-110	50	2"	3.000	7.065	6.5	13.0	16.3	5	5.81	7.27	0.74	0.23
XV-106	Permeate to Spiral Feed Tank, T-200	50	2"	3.000	7.065	6.5	13.0	16.3	5	5.81	7.27	0.74	0.23
XV-107	Concentrate to VSEP Feed Tank, T-110	50	2"	2.066	3.351	10.0	20.0	25.0	5	8.94	11.18	2.40	0.73
XV-108	Concentrate to Reject Tank, T-120	50	2"	2.066	3.351	10.0	20.0	25.0	5	8.94	11.18	2.40	0.73
XV-110	CIP Feed to VSEP #1	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-111	CIP Permeate From VSEP #1	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-112	Permeate From VSEP #1	50	2"	2.066	3.351	6.5	13.0	16.3	5	5.81	7.27	1.56	0.47
XV-113	CIP Concentrate From VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	5	8.94	11.18	9.29	2.83
XV-114	Concentrate From VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	5	8.94	11.18	9.29	2.83
Stage-2 Spiral RO Skid													
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
Modulated Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
FCV-200	Concentrate from Spiral RO	25	1"	1.049	.864	10.0	20.0	25.0	500	0.89	1.12	9.29	2.83
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
On/Off Pneumatic Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-200	Hot water in	50	2"	2.583	5.237	45.0	90.0	112.5	5	40.25	50.31	6.90	2.10
XV-201	Feed to Spiral from feed tank	50	2"	2.583	5.237	25.0	50.0	62.5	5	22.36	27.95	3.83	1.17
XV-202	Feed Pump, P-201 Outlet	50	2"	2.583	5.237	25.0	50.0	62.5	5	22.36	27.95	3.83	1.17
XV-203	Feed In from CIP Skid	50	2"	2.583	5.237	45.0	90.0	112.5	5	40.25	50.31	6.90	2.10
XV-205	Spiral Permeate out to CIP Skid	40	1.5"	1.612	2.040	37.5	75.0	93.8	5	33.54	41.93	14.75	4.50
XV-206	Spiral Permeate to Destination, T-300	40	1.5"	1.612	2.040	18.8	37.5	46.9	5	16.77	20.96	7.38	2.25
XV-207	Spiral Permeate to Feed Tank, T-200/210	40	1.5"	1.612	2.040	18.8	37.5	46.9	5	16.77	20.96	7.38	2.25
XV-204	Spiral Concentrate out to CIP Skid	25	1"	1.049	.864	7.5	15.0	18.8	5	6.71	8.39	6.97	2.12
XV-208	Spiral Concentrate to Reject Tank, T-120	25	1"	1.049	.864	6.3	12.5	15.6	5	5.59	6.99	5.81	1.77
CIP Skid													
		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-190	Hot Water to CIP Tank	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-191	Hot Water to VSEP	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-192	CIP Tank to Drain	50	2"	2.066	3.351	2.5	5.0	6.3	5	2.24	2.80	0.60	0.18
XV-193	CIP Tank to Pump	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-194	CIP Pump to Feed Header	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-195	Feed Bypass to CIP Tank	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-196	Permeate to CIP Tank	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-197	Permeate to Destination	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-198	Concentrate to CIP Tank	40	1-1/2"	1.612	2.040	10.0	20.0	25.0	5	8.94	11.18	3.93	1.20
XV-199	Concentrate to Destination	40	1-1/2"	1.612	2.040	10.0	20.0	25.0	5	8.94	11.18	3.93	1.20

FLO-TITE valves & controls

2PC Full Bore Economical Ball Valve

2PC ECONOFLO SERIES

Model : T80SS

1000 WOG / 150 SWP
316 Stainless Steel
Optional Carbon Steel

Temperature Range:
-20 °F to 450 °F
-46 °C to 232 °C

Size Range:
1/4" - 3"
Threaded Ends

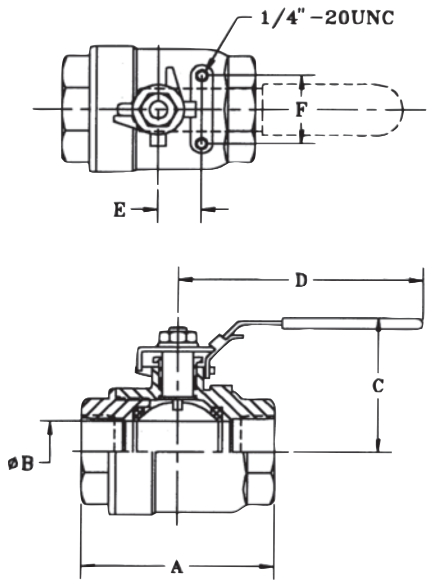
DESIGN FEATURES

- Full Port - Straight through flow minimizes pressure drop and prolongs valve life
- Internal Entry Blow-out Proof Stem
- Locking Handle - Standard on all valves meets OSHA 1910.147
- Adjustable V-Ring Stem Packing
- Bubble Tight - Zero Leakage
- Actuator Mounting Pad
- Investment cast improves dimensional control and reduces porosity
- 2PC Econoflo Series is an Ideal General purpose stainless steel valve, meeting plant - wide applications

Econoflo Series offers exceptional economy and proven performance

FLO TITE
valves & controls

T80SS Full Port Ball Valve Design & Technical Data



DIMENSIONS AND WEIGHTS:

SIZE		1/4”	3/8”	1/2”	3/4”	1”	1 1/4”	1 1/2”	2”	2 1/2”	3”
A	in	2.20	2.20	2.52	2.95	3.35	3.86	4.17	4.80	6.38	7.01
	mm	56	56	64	75	85	98	106	122	162	178
ϕB	in	0.43	0.47	0.59	0.79	0.98	1.26	1.50	1.97	2.56	3.07
	mm	11	12	15	20	25	25	32	50	65	78
C	in	1.89	1.89	2.24	2.36	2.80	3.13	3.46	3.86	4.88	5.41
	mm	48	48	57	60	71	79.5	88	98	124	137.5
D	in	3.54	3.54	3.94	4.53	5.51	5.51	7.09	7.48	8.66	9.45
	mm	90	90	100	115	140	140	180	190	220	240
CV		6	7	10	25	35	46	80	110	310	360
Torque (in-lbf)		36	36	65	80	120	235	290	370	685	810
Weight (lbs)		0.66	0.66	0.79	1.28	2.29	3.39	4.97	8.36	15.0	25.5

Dimensions are for estimating purpose only.
Please consult factory for exact dimensions.

All valves 100% air tested underwater
at 100 psi Open and Close positions.

BILL OF MATERIALS:

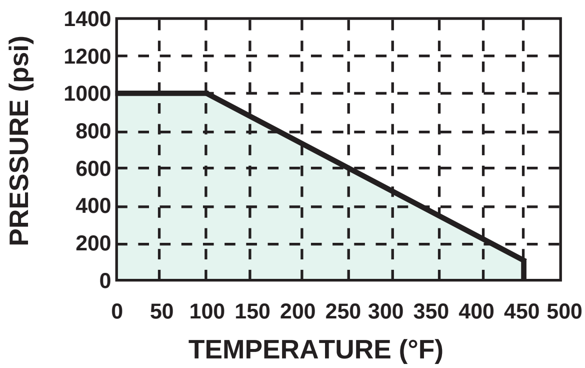
ITEM	NAME	T80SS	T80CS	QTY.
1	BODY	ASTM A351 GR. CF8M	ASTM A216 GR. WCB	1
2	END CAP	ASTM A351 GR. CF8M	ASTM A216 GR. WCB	1
3	BALL	ASTM A276 TYPE316	ASTM A276 TYPE316	1
4	SEAT	RPTFE	RPTFE	2
5	BODY SEAL	PTFE	PTFE	1
6	STEM	ASTM A276 TYPE316	ASTM A276 TYPE316	1
7	THRUST WASHER	RPTFE	RPTFE	1
8	STEM PACKING	RPTFE	RPTFE	2
9	GLAND NUT	ASTM A492 TYPE304	CARBON STEEL	1
10	HANDLE	ASTM A167 TYPE304	CARBON STEEL	1
11	LOCKING DEVICE	ASTM A167 TYPE304	CARBON STEEL	1
12	LEVER SLEEVE	VINYL PLASTISOL	VINYL PLASTISOL	1
13	SPRING WASHER	ASTM A492 TYPE304	CARBON STEEL	1
14	NUT	ASTM A492 TYPE304	CARBON STEEL	1

Conforms to:
Federal Specification WW-V-35B
Type II, Class C. Style 3

Pipe Thread in accoardance with
ANSI B2 NPT

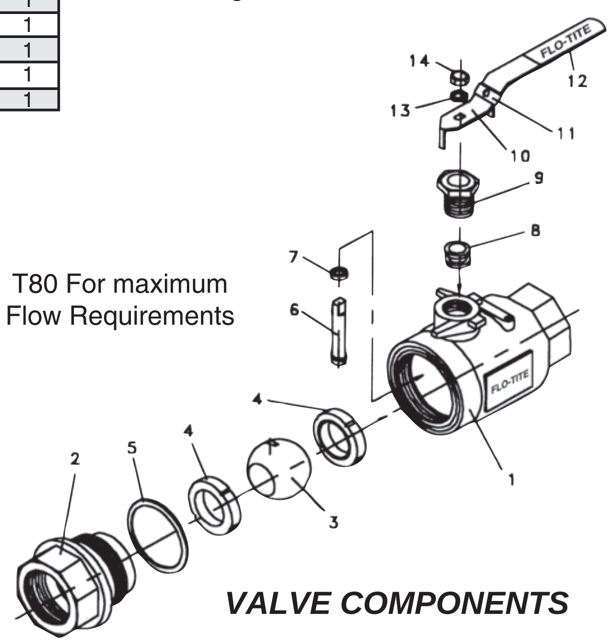
Drilled and Tapped Actuator
Mounting Pad

PRESSURE AND TEMPERATURE DATA



PRESSURE RATING: 1000 WOG

T80 For maximum
Flow Requirements

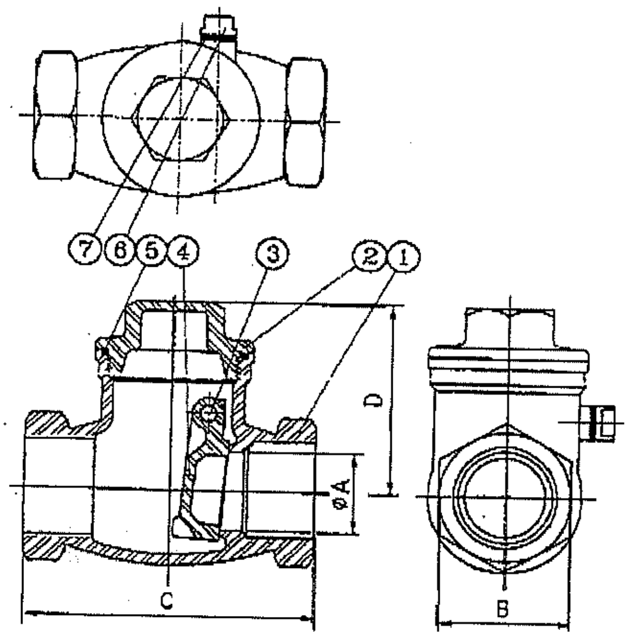


VALVE COMPONENTS

JFW VALVE®

200# Socket Weld Swing Check Valve

FIG. #SC-200SW



MATERIALS LIST

NO.	PART NAME	SPECIFICATION	QTY
[illegible]	[illegible]	[illegible]	[illegible]
2	COVER	CF8M	1
[illegible]	[illegible]	[illegible]	[illegible]
4	DISC	CF8M	1
[illegible]	[illegible]	[illegible]	[illegible]
6	PLUG NUT	SS316	1
[illegible]	[illegible]	[illegible]	[illegible]

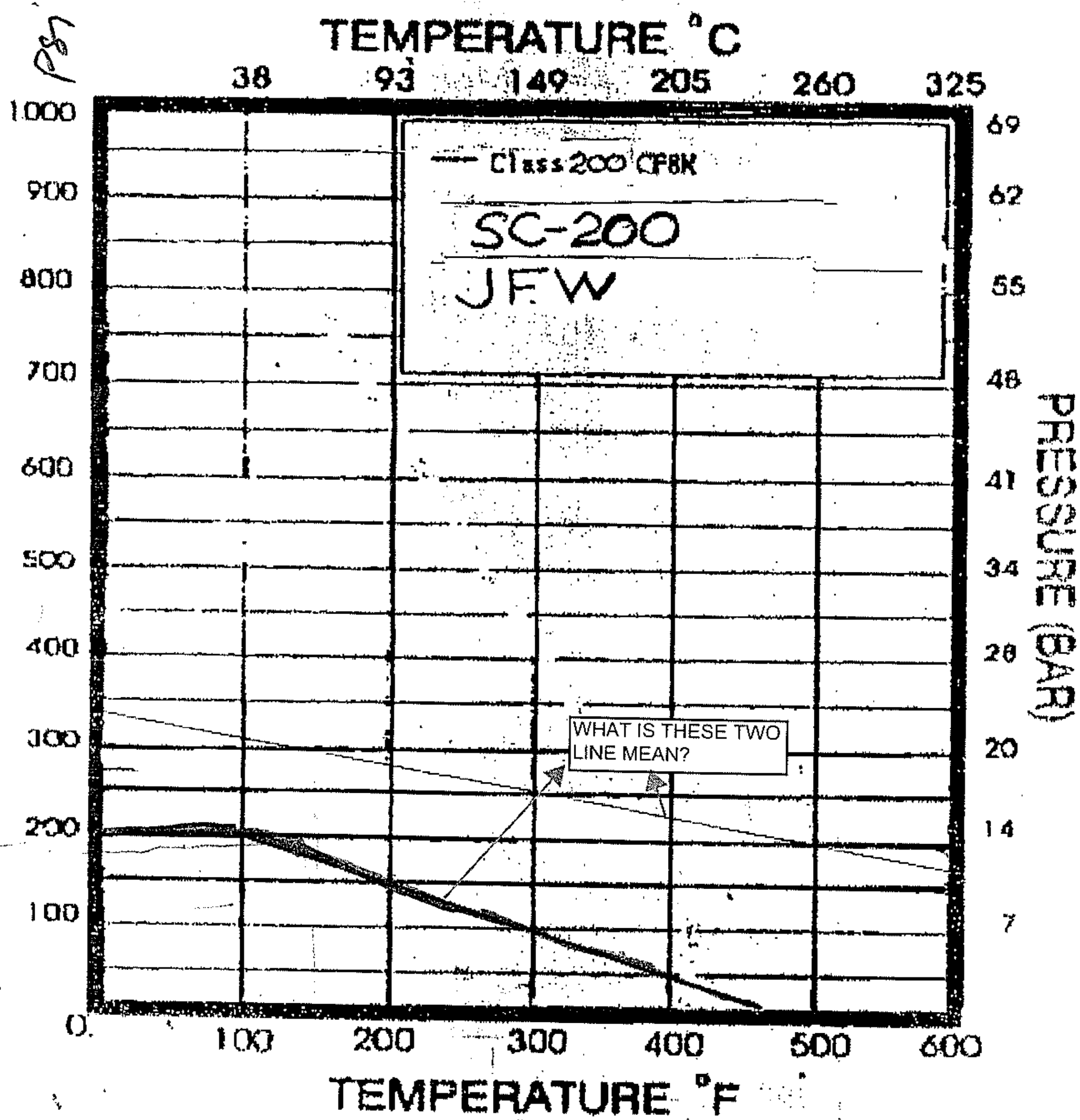
SPECIFICATIONS:

- Made by Investment Cast
- Screwed-In Cap

DIMENSIONS

SIZE	A		B		C		D		SOCKET DEPTH	UNIT WEIGHT
	MM	IN	MM	IN	MM	IN	MM	IN		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3/4"	20	.79	32	1.26	80	3.15	51	2.01	.56	1.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1-1/4"	32	1.26	50	1.97	105	4.13	66	2.60	.70	3.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2"	50	1.97	70	2.76	140	5.51	80	3.15	.81	6.0

PRESSURE-TEMPERATURE RATING



3 PC Full Port Ball Valves

Flo-Tite's Unique...

MULTI-CHOICE SERIES

1500 WOG

I - S0 - Mount

Models:

300 - (316SS)
200 - (WCB)

SIZE 1/4" - 2 1/2"

Shown with Optional Weld-In-Place Ends

SIZE 3" & 4"
Optional 6" thru 12"

SPECIAL FEATURES

- I-SO-MOUNT TYPE AUTOMATION PAD
- WELD IN PLACE DESIGN
- SECONDARY MEDIA CONTAINMENT
- SECONDARY METAL SEAT
- LIVE-LOADED STEM ASSEMBLIES
- SWING-OUT BODY DESIGN
- SAFETY LOCKING HANDLE
- ANTI-STATIC GROUNDING DEVICE
- SUPER-TEK-SEATS, STANDARD
- CAVITY FILLER - ALL SIZES
- METAL NAME PLATES IDENTIFY ALL SOFT PARTS

END CAP SELECTION

- THREADED (NPT)
- SOCKET WELD
- BUTT WELD
- 150 LB. FLANGED
- TRI CLAMP-SANITARY END
- CAM LOCK
- TUBE END
- FLUSH BOTTOM TANK
- EXTENDED END SW
- EXTENDED END B/W

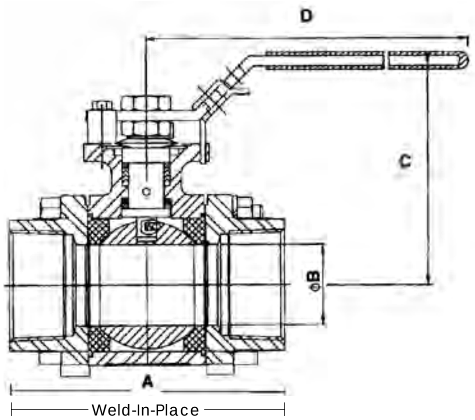
V-Port Control Valve Characterized Ball V15°, V30°, V60°, V90°

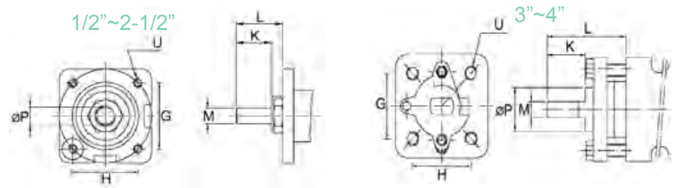
UNIQUE DESIGN

- SIZE Range 1/4" thru 4" Optional 6"~12"
- 1500 WOG/150 WSP 1/4" ~ 2", 2-1/2"~ 4", ANSI 150/300 6"~12"
- Cap Screws are used to insure precise alignment of valve center body to end caps. This high-end design feature eliminates through bolts, nuts,washer and their related problems.

Unique 3PC Design Serves As Both Valve And Union Thus Eliminating Costly And Heavy Flanges!

www.flotite.com





NOTE: Verify the Mounting dimensions before manufacturing actuator mounting hardware.

SIZE	G	H	L	K	M	ϕP	U
1/2"	1.169	1.169	0.55	0.32	0.250	0.366	#10-24UNC
3/4"	1.169	1.169	0.55	0.32	0.250	0.366	#10-24UNC
1"	1.392	1.392	0.75	0.43	0.315	0.429	1/4"-20UNC
1-1/4"	1.392	1.392	0.75	0.43	0.315	0.429	1/4"-20UNC
1-1/2"	1.949	1.949	0.91	0.55	0.374	0.618	5/16"-18UNC
2"	1.949	1.949	0.91	0.55	0.374	0.618	5/16"-18UNC
2-1/2"	2.840	2.840	1.14	0.69	0.472	0.748	5/16"-18UNC
3"	3.543	1.874	3.07	1.75	0.669	1.102	1/2 - 13 UNC
4"	3.543	1.874	3.07	1.75	0.669	1.102	1/2 - 13 UNC

BILL OF MATERIALS:

Size 1/4" thru 4" inch

NO.	PART NAME	300 SERIES STAINLESS STEEL	200 SERIES CARBON STEEL	Q'TY
1	BODY	ASTM A351 GR. CF8M - 316	ASTM A216 GR. WCB	1
2	CAP END CONNECTOR	ASTM A351 GR. CF8M **	ASTM A216 GR. WCB	2
3	BALL	ASTM A351 GR. CF8M - 316	ASTM A351 GR. CF8M - 316	1
4	SEAT *	SUPER-TEK TFM or RTFE	SUPER-TEK TFM or RTFE	2
5	STEM	ASTM A276 TYPE 316	ASTM A276 TYPE 316	1
6	BODY SEAL *	SUPER-TEK TFM OR RTFE	SUPER-TEK TFM OR RTFE	1
9	BODY BOLT	S.S 304 / ASTM A193 GR B8	S.S 304 / ASTM A193 GR B8	8/12
10	ANTI-STATIC	SS316	SS316	2
11	THRUST BEARING *	25% CARBON/TFM	25% CARBON/TFM	1
12	GUIDE SEAL *	VITON O-RING	VITON O-RING	1
14	STEM PACKING *	SUPER-TEK-TFM	SUPER-TEK-TFM	3
15	PACKING GLAND SLEEVE	SS304	SS304	1
18	BELLEVILLE WASHER	SS301	SS301	2
19	LOCK WASHER	SS304	SS304	1
23	VAVLE STOP - SET SLEEVE	SS304	SS304	1
24	VAVLE STOP - BOLT	SS304	SS304	1
25	LEVER HANDLE	SS304	SS304	1
26	THIN NUT	SS304	SS304	2
28	LEVER SLEEVE	PLASTIC	PLASTIC	1
29	LOCKING DEVICE	SS304	SS304	1

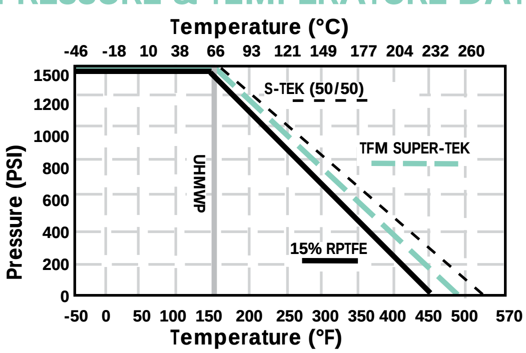
* Recommended Spare Parts (Consult factory for B8 and B7 bolting) ** Weld Ends use CF3M-316L

DIMENSIONS, TORQUES, AND WEIGHTS:

SIZE	A	WELD-IN PLACE	ØB	C	D	WEIGHT (lbs)	TORQUE (in-lbs)	CV
1/4", 3/8", 1/2	2.835	4.71	0.591	2.598	6.496	2.10	50	18
3/4"	3.346	5.02	0.787	2.913	6.496	2.43	70	42
1"	3.622	5.31	0.984	3.425	7.874	3.51	95	74
1-1/4"	4.331	5.71	1.260	3.622	7.874	5.07	190	130
1-1/2"	4.843	6.23	1.496	4.134	9.843	8.00	200	210
2"	5.591	6.76	2.000	4.528	9.843	12.00	340	380
2-1/2"	7.264	8.76	2.559	5.039	9.843	22.00	480	645
3"	7.953	9.45	2.992	6.417	15.354	32.50	780	890
4"	9.055	10.56	4.016	7.087	15.354	56.00	1600	1,620

Consult factory for sizes 6 thru 12 inch

PRESSURE & TEMPERATURE DATA



OPTIONAL SEAT MATERIALS

- UHMWP-Ultra High Molecular Weight Polyethylene
- Carbon Filled Teflon
- Bronze Filled Teflon
- Stainless Teflon
- Virgin Teflon
- Peek
- Stellite-Metal
- Super-Tek (TFM)
- Super-Tek III (Carbon/TFM)
- Cavity Fillers

* Carbon Steel Bodies are Black Phosphate Coated for Added Corrosion Resistance
* All Carbon Body Valves Have Stainless Steel Hardware

DESIGN & TECHNICAL DATA

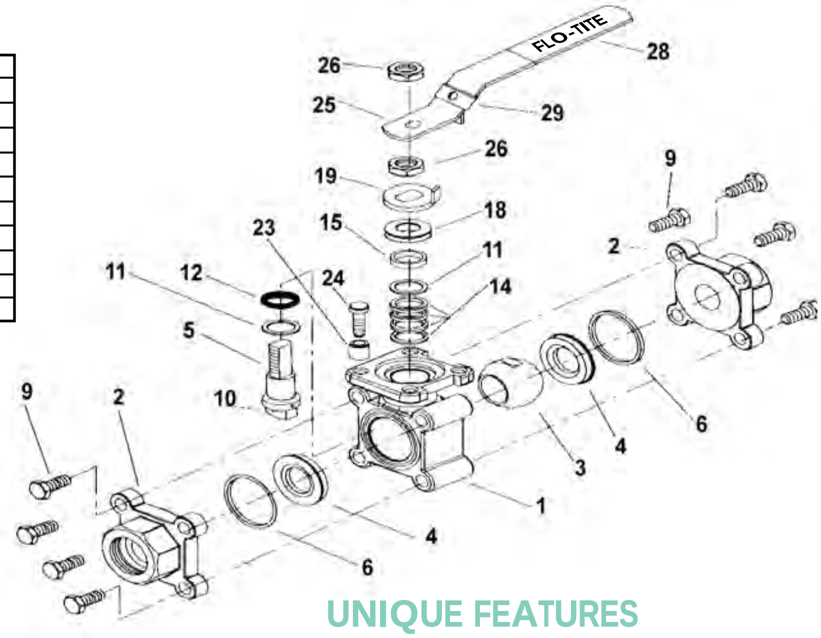
Model Numbers:

End Connections:

STAINLESS	CARBON	CONNECTIONS:
310	210	THREADED END
320	220	SOCKET WELD
330	230	BUTT WELD
340	240	150 LB. FLANGE
350	250	TRI CLAMP-SANITARY E
360	260	CAM LOCK
370	270	TUBE END
395	395	EXTENDED END B/W
390	290	GROVED END
TK300	TK200	FLUSH BOTTOM TANK

Any combination of above end connections are available C/F.
Consult Ball Valve Identification Code Guide for Full Part Number, Tech Bulletin page 188-07

Exploded View For 1/4"~2-1/2"



VALVE COMPONENTS

SPECIFICATION STANDARDS:

- **Threaded End, ANSI B1.20.1 NPT**
- **Socket Weld, ANSI B16.11**
- **Butt Weld MSS SP72**
- **Meets WW-V35C Type II Composition: SS Style**
- **Shell Wall ANSI B16.34**
- **Flanged End Class 150 or 300**
- **Valve Body and Caps are high quality investment castings**
- **NACE MR-01.75 compliant**
- **ISO 5211 Mounting Pad**

RATINGS:

- **Pressure Rating:**
  Threaded, Socket Weld
  Butt Weld schedules 5, 10, & 40
  Size 1/4" thru 4" - 1500 WOG
  Size 6" and larger Butt Weld, Socket Weld, Threaded End - 800 WOG
- **Flanged End ANSI 150/300**
- **Steam Rating: 150 PSI WSP**
  250 PSI steam rated valves are available with Super-Tek III seats
- **Vacuum service to 20 microns**

All Valves Tested to MSS SP-72 at 100 psi under Water in Open and Closed Positions

UNIQUE FEATURES

Ball Design Added Safety Feature:
As an added safety feature, there is a hole in the stem slot of each ball to equalize pressure between the body cavity and the flow stream when valve is in the open position.

Relief Holes in Seats Relieve Pressure Past the Upstream Seat.

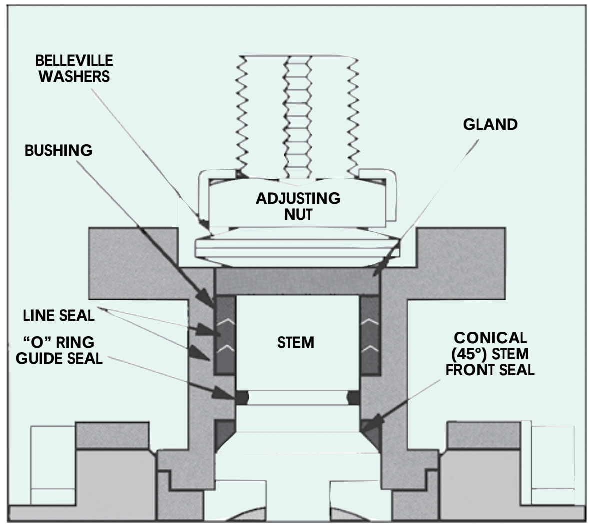
Flo-Tite's safety lockable handle designed to prevent accidental movement.

The valve can also be padlocked to limit unwanted access.

Flo-Tite's QUALITY CONTROL INCLUDES:

√√ All castings go through spectroscopic analysis
√√ Microstructure test after solution heat treating
√√ Inspection of appearance after shot blasting
√√ Size/dimension gauge test after CNC machining
√√ Final pressure leakage test at 100 PSI under water in Open and Closed positions.

FLO TITE
valves & controls



Flo-Tite's Van Guard stem sealing system, designed to minimize fugitive emissions. Increases safety and provides an immediate ball valve solution to the newer EPA performance requirements, for valves meeting with a leak rate of 500ppm.

Flo-Tite's Van Guard seal, state of the art stem sealing system. Incorporating a triple set of valve stem seals. This unique system eliminates the possibility of valve stem leaks in most all media applications.

STAGE I - FRONT LINE
Stage I provides a front line defense against leakage. The blow-out proof stem shoulder has a 45 degree bell shaped slope. The bell shaped design offers more sealing surface, effectively blocking all leak paths during rotation. The wedging action of the portion of the stem is far superior to the common small flat stem shoulder design.

STAGE II - GUIDE-SEAL
The O-ring originated early in valve design and has been a proven performer in high cycle applications. Its basic function reduces the potential of machining inperfections and provide a low torque flexible seal. This center guide also helps to maintain a perfect stem alignment, by eliminating side loading stress which can cause stem leaks.

STAGE III - LIVE-SEAL
Live-Seal is considered the intellectual component and the workhorse of Flo-Tite's Van Guard stem sealling system. Working in unison with stages I and II, stage III calls upon the use of V-Ring packing sets which expands side ways as it is compressed and pressurized blocking all air pockets. The Van-Guard stem system is energized by belleville washers which continueouly adjusts packing compression to componsate for wear, pressure or temperature flactuations.

Whether your service involves volatile organic compounds, volatile hazardous chemicals, or air pollutants. Flo-Tite's ball valves are by design dependable, long lasting and fully maintainable. Flo-Tite has various valve solutions and designs that provides end users freedom of choice for the toughest requirements imposed by the industry and by international standards.

MATERIAL IDENTIFICATION

Flo-Tites marking system follows MSS SP-25-1998 guidelines. In addition to the casted body information, we have decided to add metal name plates that identify all valve soft parts. Valve users worldwide will be able to contact Flo-Tite quickly for any installation or service requirements as the company website address will be on all valves.

WELD IN-PLACE

Super-Teks high temperature seat capabilities allow weld end ball valves to be welded to the piping system without disassembly following special welding procedures. This unique advantage results in ease of installation and cost savings while insuring full integrity of the factory assembled and tested valve.

BALL VALVE IDENTIFICATION CODE AND MATERIAL SELECTION GUIDE - 3PC VALVES

MODEL	BODY MATERIAL		SECOND END CONNECTION		SEAT		STEM SEAL		BODY SEAL		OPERATOR		SIZE	
3PC 300 200 DM310 DM320 HPF40 HPF50 TK300	316SS	SS	Threaded	1	TFM	F	TFM	F	TFM	F	Lever Locking	L	1/4	8
	WCB	CS	Socket Weld	2	CTMF	Y	CTFM	Y	RTFM	X			3/8	10
	ALLOY 20	A2	Butt Weld	3	PTFE	T	RTFM	X	PTFE	T	Oval Locking	O	1/2	15
	Brass	BZ	Flanged 150	4	RPTFE	R	PTFE	T	RPTFE	R			3/4	20
			Flanged 300	5	50/50	S	RPTFE	R	50/50	S	Gear	G	1	25
			Flanged 600	6	UHMWPE	U	50/50	S	UHMWPE	U	Deadman	S	1 1/4	32
			Flanged 900	7	PEEK	P	UHMWPE	U	PEEK	P	Actuator	A	1 1/2	40
					CAVITY FILLED	C	PEEK	P	GRAPHITE	G	Bare Stem	N	2	50
					METAL	M	GRAPHITE	G	KEL-F	K	Special	X	2 1/2	65
					KEL-F	K							3	80
													4	100

SPECIAL NOTES:

- **Model Selection:** See model selection choices, consult catalog or website for more information.
- **End Connection:** Valve model number indicates end connection type. Second End Connection notation can be used in conjunction with valve model number to indicate a combination such as: NPT x Socket Weld.
- **For V-Modulating Control V-Ball** add a 'V' before the valve model number.
- **Ball:** All ball material is supplied standard as 316SS. If different material is required please specify as a special feature.
- **Special Features** are noted at the end of the identification number, please see special feature codes.
- **Ordering Information:** When placing an order or requesting a quotation, please provide as many details on the application as possible such as: media type, temperature, pressure, pipe size, etc.

Ordering Example By Part Number - 3PC Valves:

* Donates Special Feature if Required.

3PC	316SS	NPT x SW	TFM	GRAPHITE	TFM	LEVER	2”	MEDIA CONTAINMENT
MODEL	BODY MATERIAL	2nd END CONNECTION	SEAT	STEM SEAL	BODY SEAL	OPERATOR	SIZE	*SPECIAL FEATURE
310	SS	2	F	G	F	L	50	H3

Tri-Star Series 3pc 1500 WOG Model Types - Full Port:

STAINLESS	CARBON	END CONNECTION
510	410	NPT Threaded
520	420	Socket Weld

Tri-Pro Series 3pc Fire Safe 2250/3000 WOG Model Types - Full Port / Standard Port:

Full Port	STAINLESS	Standard Port	Full Port	CARBON	Standard Port	END CONNECTION
HPF51		HPS51	HPF41		HPS41	NPT Threaded
HPF52		HPS52	HPF42		HPS42	Socket Weld
HPF53		HPS53	HPF43		HPS43	Butt Weld
HPF56		N / A	HPF46		N / A	Flanged - 600

Multi-Choice Series 3pc Full Port 1500 WOG Model Types - Full Port:

STAINLESS	CARBON	END CONNECTION
310	210	NPT Threaded
320	220	Socket Weld
330	230	Butt Weld
340	240	Flanged - 150
350	-	Tri Clamp
370	-	Tube End
TK300	TK200	Tank Pad

TB Series
True Union Ball Valves

1/4" TO 2" PVC AND CPVC

NSF

Sizes 1/4" – 2"

KEY FEATURES

- PVC and CPVC
- Full Port Design
- Reversible PTFE Seats
- Double O-Ring Stem Seals
- Easily Actuated
- NSF / ANSI 61 Listed

OPTIONS

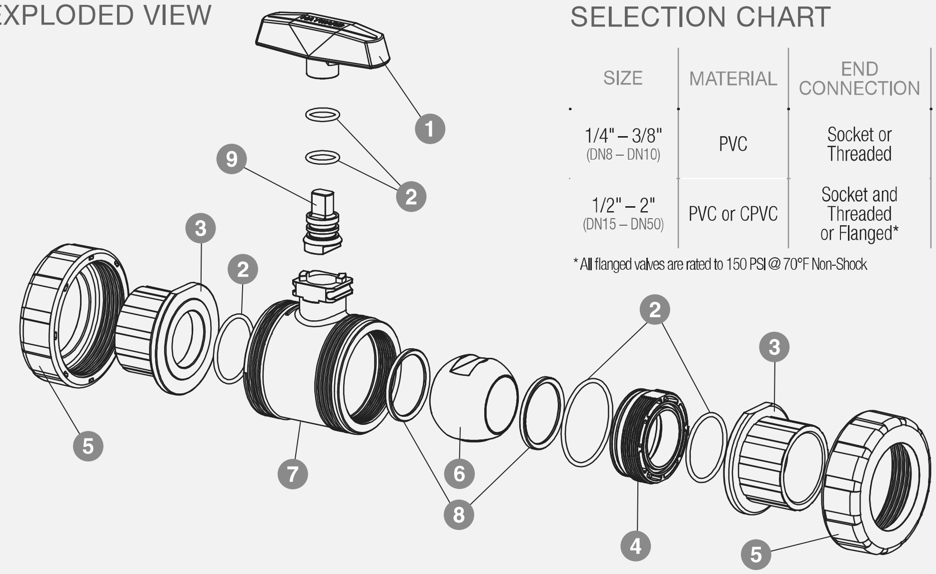
- Lockouts Available
- 2" Square Operating Nut
- Stem Extensions
- Pneumatic and Electric Actuated
- Spring Return Handle

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/4" – 3/8" (DN8 – DN10)	PVC	Socket or Threaded	FPM or EPDM	250 PSI @ 70°F Non-Shock
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded or Flanged*		

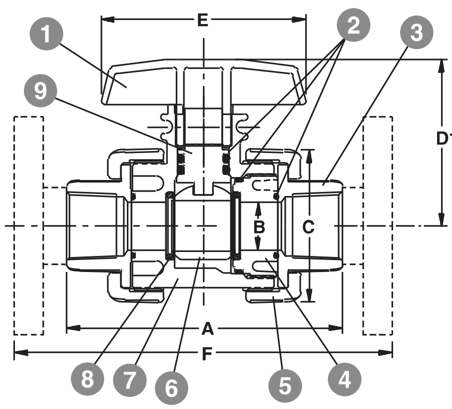
* All flanged valves are rated to 150 PSI @ 70°F Non-Shock

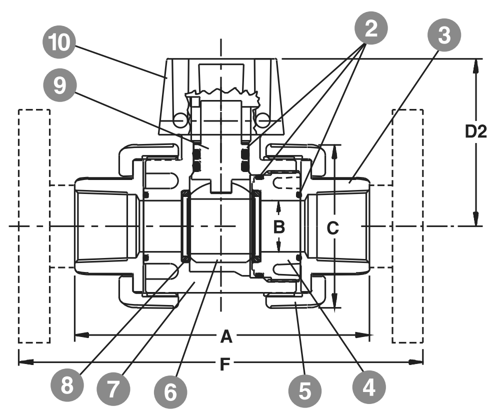
TB Series
True Union Ball Valves
1/4" TO 2" PVC AND CPVC

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Handle
2. O-Ring Seals
3. End Connector
4. Seal Retainer
5. Union Nut
6. Ball
7. Body
8. PTFE Seat
9. Stem
10. Actuator Mounting Pad





DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D1 in / mm	D2 in / mm	E in / mm	F in / mm	WEIGHT lbs / kg SOC / THD	FLANGED
1/4 / 8	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
3/8 / 10	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
1/2 / 15*	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	6.75 / 171	.75 / .34	1.00 / .45
3/4 / 20*	4.85 / 123	.75 / 19	2.63 / 67	3.02 / 77	2.81 / 71	3.50 / 89	7.13 / 181	.75 / .34	1.00 / .45
1 / 25*	5.44 / 138	.93 / 24	3.00 / 76	3.26 / 83	3.05 / 77	4.00 / 102	8.09 / 205	1.15 / .52	2.15 / .98
1-1/4 / 32*	6.30 / 160	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.19 / 233	2.15 / .98	3.50 / 1.59
1-1/2 / 40*	6.85 / 174	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.88 / 251	2.15 / .98	3.75 / 1.70
2 / 50*	8.00 / 203	1.94 / 49	4.75 / 121	4.43 / 113	4.00 / 102	5.00 / 127	11.4 / 290	3.80 / 1.72	6.30 / 2.86

Dimensions are subject to change without notice – consult factory for installation information
* Metric End Connections Available In: BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Cv VALUES

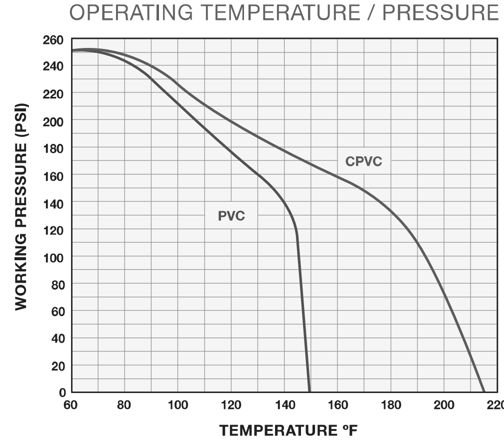
SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/4 / 8	1.0	1 / 25	29.0
3/8 / 10	2.8	1-1/4 / 32	75.0
1/2 / 15	8.0	1-1/2 / 40	90.0
3/4 / 20	16.0	2 / 50	150.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

OPERATING TEMPERATURE / PRESSURE



TC Series True Union Ball Check Valves

1/4″ to 6″ PVC, Corzan® CPVC, PPL

Backflow Prevention

Hayward True Union Ball Check Valves prevent reversal of flow in piping systems. They are ideal where backflow could potentially cause damage to pumps, filters, or process equipment.

Automatic Operation

Hayward True Union Ball Check Valves operate without the need for any adjustments or settings. Line pressure moves the solid plastic ball off the elastomer seat, opening the valve. When the inlet flow stops, back pressure moves the ball back onto the seat – stopping the flow. Additionally, this valve features a unique square-cut elastomer seat to seal at low back pressures.

True Union Design

Sizes 1/2″ to 6″ feature a true union design. This allows for easy removal from a piping system without breaking down piping connections. Just unscrew the two assembly nuts and lift the valve body out of the line. A Trim Check design is used for the 1/4″ and 3/8″ sizes. While not true union, the valves are fully repairable, unlike some other smaller check valves.

No Corrosion Failures

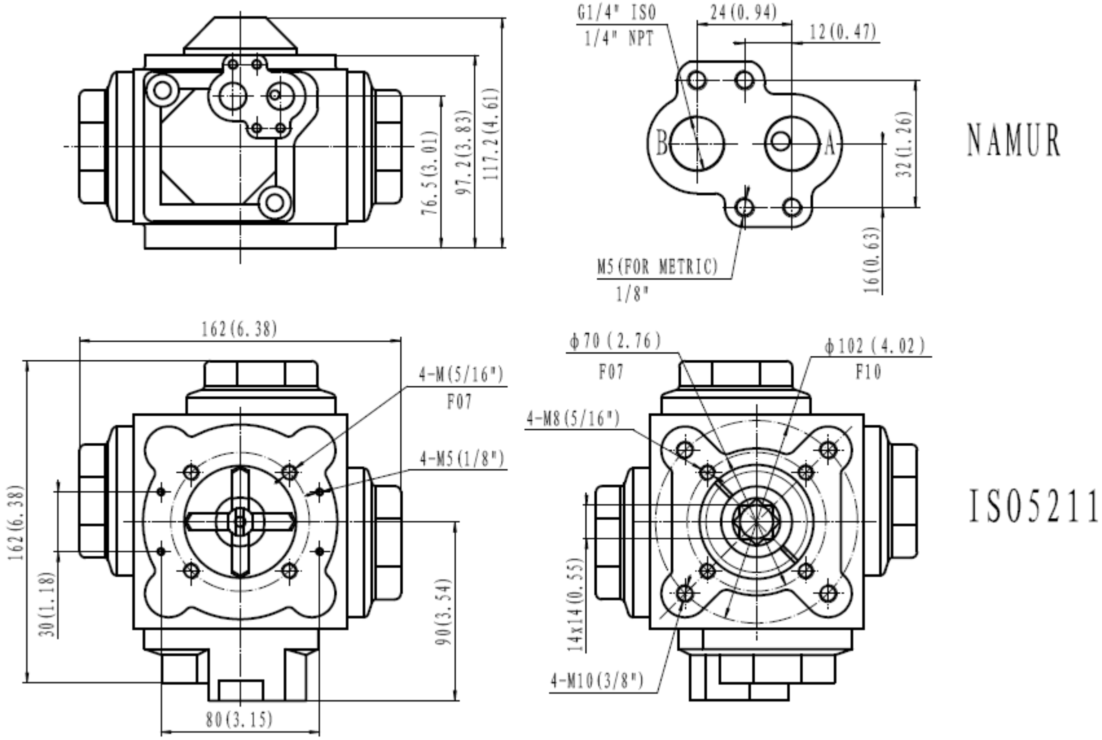
Because of their all-plastic construction, these valves will never jam or stick as a result of rust or corrosion. Also they will not contaminate sensitive fluids that come into contact with them.

Features

- Full Port Design to 4″
- True Union Design
- Easy Maintenance
- FPM or EPDM Seals
- Unique Square Cut Seat
- Works in Any Position Except Downflow

Options

- Foot Valve Screens



MODEL NO.	
ALF-25	
PRODUCT LINE	
ALPHA ALF Series Komp 4 Actuator	
TECHNICAL DATA	
Operating Temperature	Standard:-20℃-80℃ On requires: -20℃-120℃ -40℃-80℃
Connection Interface	NAMUR, ISO 5211
Travel adjustment	±5° at both open and closed directions(90°)
Approval	CE 0575 Ex II 2 GD EEX c IIC T6

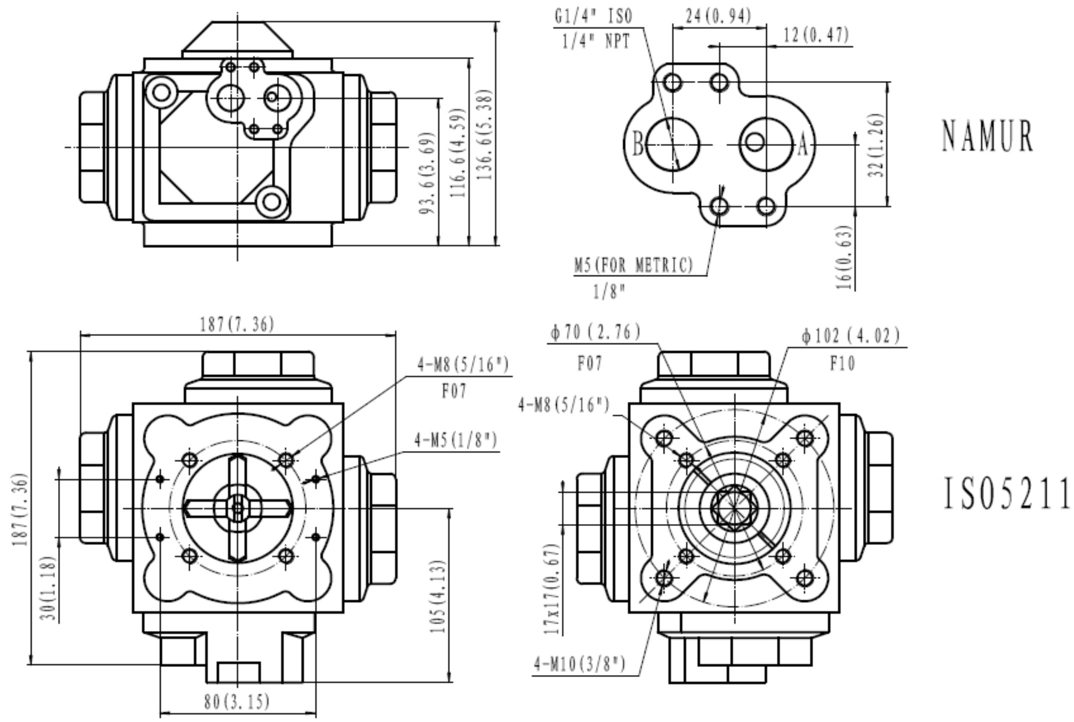
Output Torque (DA)

Bar	3	4	5	5.5	6	7	8
Nm	39	52	65	72	79	92	105

Output Torque (SR)

Bar / Nm	3		4		5		5.5		6		7		8		Spring Stroke	
Code	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
S2M4	25	15	38	27	51	40	58	47	65	53	78	66	90	78	23	13
S4M4	23	11	36	23	49	36	55	42	62	49	75	62	88	74	28	16
S4M2L2			33	19	46	32	53	39	60	45	73	58	86	70	32	18
S4L4					43	27	50	34	57	41	70	53	83	66	36	21
S4M4L2					41	22	47	29	54	36	67	48	80	61	42	24
M4L4					38	18	45	24	52	31	64	44	77	56	47	27
S2M4L4							43	19	50	25	63	38	75	50	52	29
S4M4L4									47	21	60	34	73	46	57	31

Wuxi St.hans Air Controls Export / Import Co.,Ltd.
No.48 Xihong Road, Meicun Industrial Park, New Area Wuxi, Jiangsu, 214112, China
Tel: 86-0510-85222125 Fax: 86-0510-85223552 www .a-torque.com



MODEL NO.	
ALF-30	
PRODUCT LINE	
ALPHA ALF Series Komp 4 Actuator	
TECHNICAL DATA	
Operating Temperature	Standard:-20℃-80℃ On requires: -20℃-120℃ -40℃-80℃
Connection Interface	NAMUR, ISO 5211
Travel adjustment	±5° at both open and closed directions(90°)
Approval	CE 0575 Ex II 2 GD EEX c IIC T6

Output Torque (DA)

Bar	3	4	5	5.5	6	7	8
Nm	62	84	107	119	130	153	176

Output Torque (SR)

Bar / Nm	3		4		5		5.5		6		7		8		Spring Stroke	
Spring Code	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
S2M4	40	26	62	47	84	70	96	81	107	92	130	114	152	136	35	21
S4M4	36	19	57	40	80	62	91	73	102	84	125	107	148	129	42	26
S4M2L2			52	30	75	52	86	63	98	74	120	96	143	118	53	31
S4L4			48	18	70	43	81	54	93	65	115	87	138	109	62	36
S4M4L2					66	36	77	47	89	58	111	80	134	103	69	40
M4L4					64	25	73	39	85	50	107	72	130	94	78	44
S2M4L4									80	40	102	62	125	85	88	49
S4M4L4									75	33	98	55	120	77	96	54

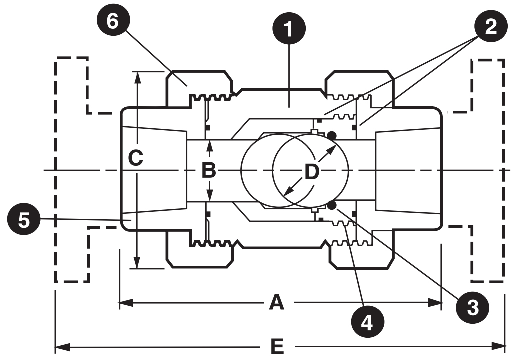
ALPHA®
www.a-torque.com

Wuxi St.hans Air Controls Export / Import Co.,Ltd.
No.48 Xihong Road, Meicun Industrial Park, New Area Wuxi, Jiangsu, 214112, China
Tel: 86-0510-85222125 Fax: 86-0510-85223552 www .a-torque.com

ALLIED®
www.allied-flow.com

Technical Information

True Check with foot valve screen installed



Parts List True Union Ball Check Valves

1. Body
2. O-Ring Seals
3. Square Cut O-Ring Seat
4. Seal Retainer
5. End Connector
6. Union Nut

Dimensions - Inches / Millimeters

Size	A	B	C	D	E	F	G	Weight - (lb / kg) Socket/ Threaded	Flanged
1/4″	3.06 / 78	0.31 / 8	1.38 / 35	0.50 / 13	N/A	N/A	N/A	0.13 / .06	N/A
3/8″	3.06 / 78	0.31 / 8	1.38 / 35	0.50 / 13	N/A	N/A	N/A	0.13 / .06	N/A
1/2″ / 20*	4.63 / 118	0.50 / 13	2.25 / 57	0.75 / 19	6.75 / 171	4.88 / 124	2.32 / 59	0.75 / .34	1.00 / .45
3/4″ / 25*	4.75 / 121	0.75 / 19	2.63 / 67	1.0 / 25	7.13 / 181	5.00 / 127	2.60 / 66	0.75 / .34	1.38 / .63
1″ / 32*	5.25 / 133	1.00 / 25	3.00 / 76	1.25 / 32	7.75 / 197	5.88 / 14	2.88 / 73	1.25 / .57	2.13 / .97
1-1/4″ / 40*	6.30 / 160	1.25 / 32	4.00 / 102	1.75 / 44	9.19 / 233	6.94 / 17	3.75 / 95	2.00 / .90	3.75 / 1.70
1-1/2″ / 50*	6.75 / 171	1.50 / 38	4.00 / 102	1.75 / 44	9.75 / 248	7.06 / 17	3.75 / 95	2.00 / .90	3.75 / 1.70
2″ / 63*	8.00 / 203	1.94 / 49	4.75 / 121	2.25 / 57	11.25 / 286	8.56 / 217	4.50 / 114	3.75 / 1.70	5.75 / 2.60
2-1/2″	10.68 / 271	2.88 / 73	6.56 / 167	3.25 / 83	14.38 / 365	11.25 / 286	2.50 / 64	10.00 / 4.54	14.00 / 6.36
3″ / 90*	10.56 / 268	2.88 / 73	6.56 / 167	3.25 / 83	14.38 / 365	11.25 / 286	2.50 / 64	10.00 / 4.54	14.00 / 6.36
4″ / 110*	12.94 / 329	4.00 / 102	8.56 / 217	4.25 / 108	17.00 / 432	14.63 / 372	4.25 / 108	17.00 / 7.72	25.00 / 11.36
6″	N/A	4.00 / 102	N/A	4.25 / 108	19.19 / 487	N/A	N/A	N/A	30.20 / 13.73

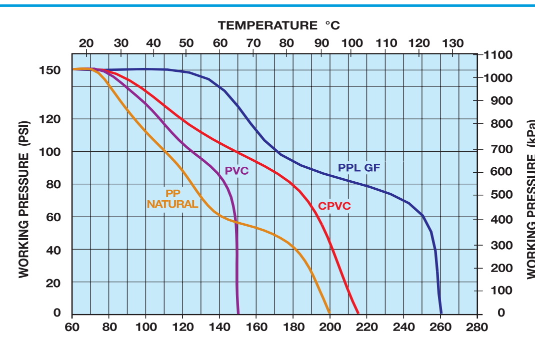
* **Metric End Connections Available in:** BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Selection Chart

Size	Material	End. Conn.	Seals	Pressure Rating
1/4″ - 3/8″*	PVC	Socket or Threaded	FPM	150 PSI @70°F Non-Shock
1/2″ - 4″	PVC or CPVC	Socket, Threaded, or Flanged	FPM or EPDM	
1/2″ - 2″	NAT. PPL***	Threaded	FPM	
6″**	PVC or CPVC	Flanged		

*Trim Check Design
** 4″ Valve Venturied to 6″
*** 2″ Rated at 100 PSI

Operating Temperature/Pressure



Pressure Loss Calculation Formula

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

Cv Factors

Size	Factor	Size	Factor
1/4″	1.0	1-1/2″	45
3/8″	3.0	2″	130
1/2″	4.8	2-1/2″	170
3/4″	7.7	3″	250
1″	11	4″	400
1-1/4″	25	6″	340

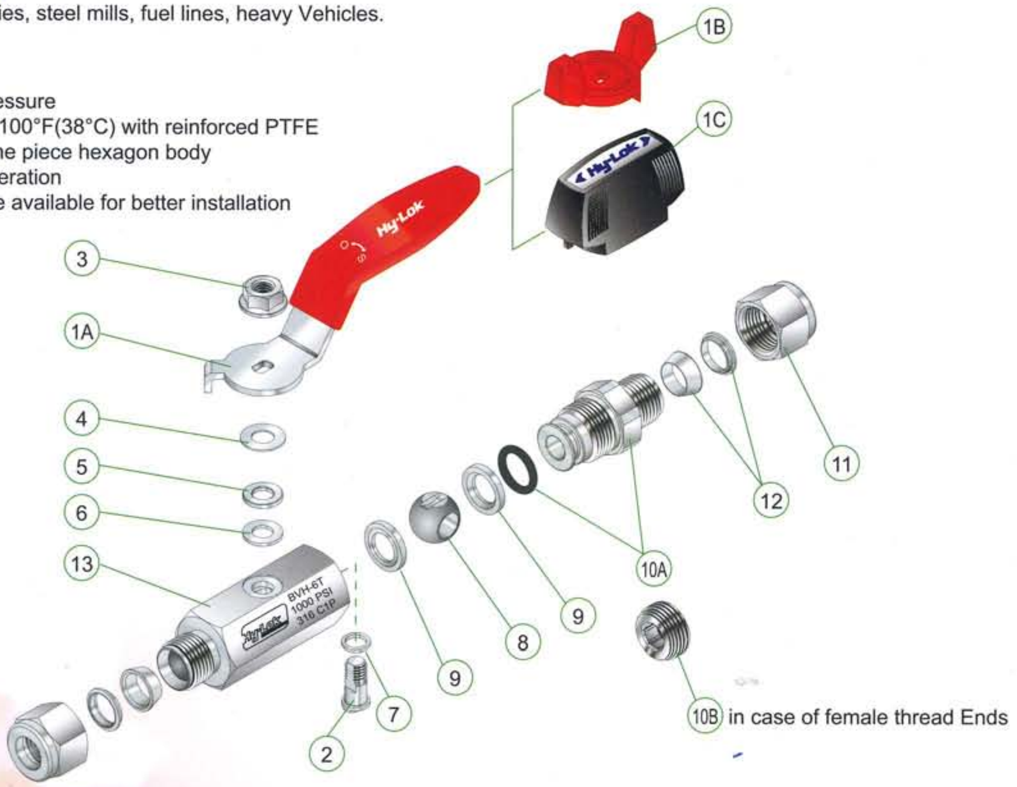
Hy-Lok 110 Series
Ball Valves

for use with 1/4" thru 2" Tube and Piping Systems

Catalog No. H-110BV
Mar. 2007

Application
Chemical plants, refineries, steel mills, fuel lines, heavy Vehicles.

Features
Maximum Operating Pressure
of 1000psig(69barg) @ 100°F(38°C) with reinforced PTFE
Compact Design with one piece hexagon body
Low Torque for easy operation
Butterfly & Nylon Handle available for better installation
in a restricted space

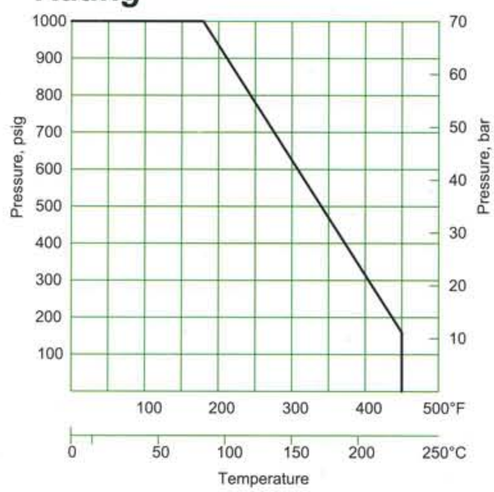


Material of Constructions

Item	Description	Grade / ASTM Specification	
		SS316	Brass
1A	Handle	SS316 Lever with Coated(Red Color)	
1B		Zinc with Nickel Plated(Red & Blue Color available)	
1C		Dielectric Nylon(Black Color)	
2	Stem	SS316 / A479	
3	Lock Nut	SS316	
4	Gland Washer	SS316	
5	Gland	SS316	
6	Outer Packing	Reinforced PTFE	
7	Inner Packing	Reinforced PTFE	
8	Ball	SS316 / A479	
9	Seat	Reinforced PTFE	
10A	End Connector	SS316 / A479	Brass / B16
		with O-Ring*	
10B	Insert	SS316 / A479	
11	Nut	SS316 / A479	Brass / B16
12	Ferrule	SS316 / A479	Brass / B16
13	Body	SS316 / A479	Brass / B16

"*"O-Ring of NBR standard, FPM(e.g Viton)on request.

Pressure-Temperature Rating



HY-LOK CORPORATION

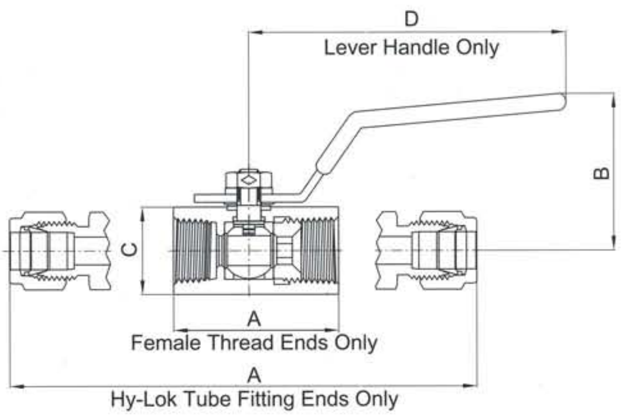


Table of Dimensions

Basic Part NO.	Orifice	Cv	End Connections	Dimensions				Weight (kg)
			Both Ends	A	B	C (Hex)	D	
BVH-6M	5.0	0.84	6mm Hy-Lok	79.5	31	17.0	60.0	0.13
BVH-4T			1/4" Hy-Lok	79.5				0.13
BVF-4N			1/4" Female NPT	40.0				0.07
BVH-10M	7.5	4.20	10mm Hy-Lok	90.0	40	20.6	80.0	0.22
BVH-6T			3/8" Hy-Lok	90.0				0.22
BVF-6N			3/8" Female NPT	45.0				0.13
BVH-12M	9.0	6.50	12mm Hy-Lok	99.0	42	27.0	80.0	0.34
BVH-8T			1/2" Hy-Lok	99.0				0.34
BVF-8N			1/2" Female NPT	54.5				0.21
BVH-16M	12.5	8.00	16mm Hy-Lok	109.0	51	32.0	100.0	0.49
BVH-10T			5/8" Hy-Lok	109.0				0.49
BVF-12N			3/4" Female NPT	61.0				0.33
BVH-12T			3/4" Hy-Lok	110.0				0.57
BVH-16T	16.0	25.00	1" Hy-Lok	134.0	55	38.0	100.0	0.85
BVF-16N			1" Female NPT	76.0				0.60
BVF-20N	21.0	-	1 1/4" Female NPT	89.0	65	50.0	151.0	0.90
BVF-24N	24.0	-	1 1/2" Female NPT	95.0	68	55.0	148.5	1.10
BVF-32N	32.0	-	2" Female NPT	110.0	73	70.0	144.0	2.00

All dimensions are in millimeters. Dimensions shown with Hy-Lok nuts in finger-tight position, where applicable.

Ordering Information

BV **H** **6T** **B** **S316**

Valve Type Designator

End Connection Designator
H : Hy-Lok Tube Fitting
F : Female Pipe Thread

Size Designator

Handle Designator
Nil : Lever
B : Butterfly Handle
N : Nylon Handle

Body Material Designator
S316 - 316 Stainless Steel
BRAS - Brass

NPT (ISO / BSP)

Thread(in.)	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Designator	4N(R)	6N(R)	8N(R)	12N(R)	16N(R)	20N(R)	24N(R)	32N(R)

Tube

Fractional Tube	O.D(in.)	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
	Designator	4T	5T	6T	8T	10T	12T	14T	16T
Metric Tube	O.D(mm)	6	8	10	12	15	16	22	25
	Designator	6M	8M	10M	12M	15M	16M	22M	25M

Note "*" : No designator is required for Lever Handle e.g. BVH-6T - S316

SAFETY in VALVE SELECTION

Proper installation, material compatibility, operation and maintenance of these valves are the responsibility of the user. The total system design must be taken into consideration to ensure optimal performance and safety.

■ QUALITY SYSTEM CERTIFICATES

ISO 9001
CERTIFICATE NO.GQC 212

ASME SECT III (MO)
CERTIFICATE NO. QSC 584

■ TYPE APPROVALS (for Hy-Lok Tube Fittings)

American Bureau Shipping
CERTIFICATE NO.00-BK50288-X

Lloyd's Register
CERTIFICATE NO.01/10075

GERMANISCHER LLOYD
CERTIFICATE NO.57798-91 HH

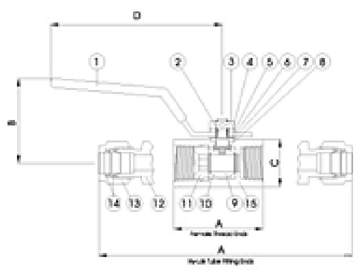
DET NORSKE VERITAS
CERTIFICATE NO.P-9100

Hy-Lok USA
7883 Airway Park
Mobile, AL 36608
Phone: 251-633-3767
Fax: 251-633-7359

110 Series: Ball Valves

Applications
• Chemical plants, refineries, steel mills. Fuel Lines, Heavy Vehicles

Features
• Maximum Operating Pressure
of 1000 psig(69 bar) at 100ºF(38ºC) with reinforced PTFE
•Compact design with one piece hexagon body
•Low torque for easy operation
•Butterfly handle is available as an option



Results 1 - 15 of 15

Part Number	Dimension A	Dimension B	Dimension C (Hex)	Dimension D	Inlet End Connection	Orifice	Outlet End Connection	List Price
BVH-6M	79.5 mm	31 mm	17 mm	60 mm	6mm Hy-Lok	5.0	6mm Hy-Lok	QUOTE
BVH-4T	79.5 mm	31 mm	17 mm	60 mm	1/4" Hy-Lok	5.0	1/4" Hy-Lok	QUOTE
BVF-4N	40 mm	31 mm	17 mm	60 mm	1/4" Female NPT	5.0	1/4" Female NPT	QUOTE
BVH-10M	90 mm	40 mm	20.6 mm	80 mm	10mm Hy-Lok	7.5	10mm Hy-Lok	QUOTE
BVH-6T	90 mm	40 mm	20.6 mm	80 mm	3/8" Hy-Lok	7.5	3/8" Hy-Lok	QUOTE
BVF-6N	45 mm	40 mm	20.6 mm	80 mm	3/8" Female NPT	7.5	3/8" Female NPT	QUOTE
BVH-12M	99 mm	42 mm	27 mm	80 mm	12mm Hy-Lok	9.0	12mm Hy-Lok	QUOTE
BVH-8T	99 mm	42 mm	27 mm	80 mm	1/2" Hy-Lok	9.0	1/2" Hy-Lok	QUOTE
BVF-8N	54.5 mm	42 mm	27 mm	80 mm	1/2" Female NPT	9.0	1/2" Female NPT	QUOTE
BVH-16M	109 mm	51 mm	32 mm	100 mm	16mm Hy-Lok	12.5	16mm Hy-Lok	QUOTE
BVH-10T	109 mm	51 mm	32 mm	100 mm	5/8" Hy-Lok	12.5	5/8" Hy-Lok	QUOTE
BVF -12N	61 mm	51 mm	32 mm	100 mm	3/4" Female NPT	12.5	3/4" Female NPT	QUOTE
BVH-12T	110 mm	51 mm	32 mm	100 mm	3/4" Hy-Lok	16.0	3/4" Hy-Lok	QUOTE
BVH-16T	134 mm	55 mm	38 mm	100 mm	1" Hy-lok	16.0	1" Hy-lok	QUOTE
BVF-16N	75 mm	55 mm	38 mm	100 mm	1" Female NPT	16.0	1" Female NPT	QUOTE

Results 1 - 15 of 15

SDL Project - Pump Totals

		Pump Information				Motor Information			
Qty	Location	Brand	Pump Model #	Capacity	Connect	HP	Motor	Motor Brand	Frame
1	VSEP Feed Pumps	Grundfos	CRN-20-10 APGVHQQV	19.8 m3/hr @ 500 psi	2" vic	25 hp	440V 3ph TEFC	Baldor	256 TC
1	VSEP Feed Pumps	Grundfos	CRN-20-9SF APGVHQQV	19.8 m3/hr @ 500 psi	2" vic	25 hp	440V 3ph TEFC	Baldor	256 TC
1	Spiral Feed Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	Spiral Feed Pump	Grundfos	CRN-15-11SF APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	CIP Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	Metering Pumps	Chemtech	X100-XC-AAAAXXX	22.5 gpd @ 60psi	3/8 MNPT	-	220V 1ph TEFC	-	-
2	Metering Pumps	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	1/2" npt	3/4 hp	220V 1ph TEFC	Baldor	56C

Note: Does not include off-skid equipment.

SDL Project - Pump's List

VSEP Feed Pump Skid - Stage 1

Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-100	Pump 100	Grundfos	CRN-20-10 APGVHQQV	19.8 m3/hr @ 500 psi	25 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
P-101	Pump 101	Grundfos	CRN-20-9SF APGVHQQV	19.8 m3/hr @ 500 psi	25 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC

CIP Skid

Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-190	CIP Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC

Spiral RO Skid - Stage2

Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-200	Pump 200	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
P-201	Pump 201	Grundfos	CRN-15-11SF APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC

Chemical Tote

Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
CP-404	NLR 404 Tote	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	3/4 hp	220V 1ph 60 Hz	316L SS, Teflon	1/2" npt	-15º to 100ºC
CP-505	NLR 505 Tote	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	3/4 hp	220V 1ph 60 Hz	316L SS, Teflon	1/2" npt	-15º to 100ºC
CP-560	NLR 560 Drum	Chemtech	X100-XC-AAAAXXX	100 gpd @ 60psi	-	220V 1ph 60 Hz	PVC, EPDM	3/8 MNPT	-15º to 100ºC

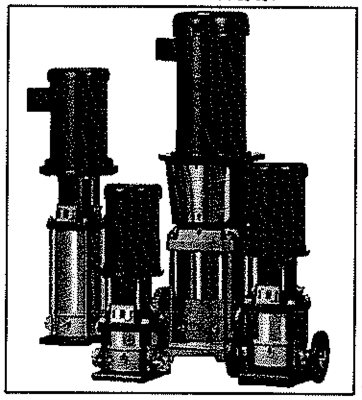
Off-Skid Pumps (provided by others)

Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-110	Fill VSEP Batch Feed Tank, T-110	Unknown	Unknown	45 m3/hr @ 30 psi	Unknown	Unknown	Unknown	Unknown	Unknown
P-120	VSEP Reject Tank, T-120 Outlet	Unknown	Unknown	10 m3/hr @ 150 psi	Unknown	Unknown	Unknown	Unknown	Unknown
P-300	VSEP Permeate Tank, T-130 Outlet	Unknown	Unknown	3 m3/hr @ 30 psi	Unknown	Unknown	Unknown	Unknown	Unknown

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	*Qty.*	*Description*	*Single Price*
	1	CRN 15-10 A-P-G-V HQQV	On request



Note! Product picture may differ from actual product

Product No.: 96523510
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:

- Impellers, intermediate chambers and outer sleeve are made of
Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr..
- Pump head cover and base are made of
Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr..
- The shaft seal has assembly length according to EN 12756.
- Power transmission is via cast iron split coupling.
- Pipework connection is via PJE (Victaulic) flanges/couplings.

The motor is a 3-phase AC motor.

Liquid:

Liquid temperature range:	253 .. 363 K

Technical:

Speed for pump data:	3497 rpm
Rated flow:	20.5 m^3/h
Rated head:	162 m
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

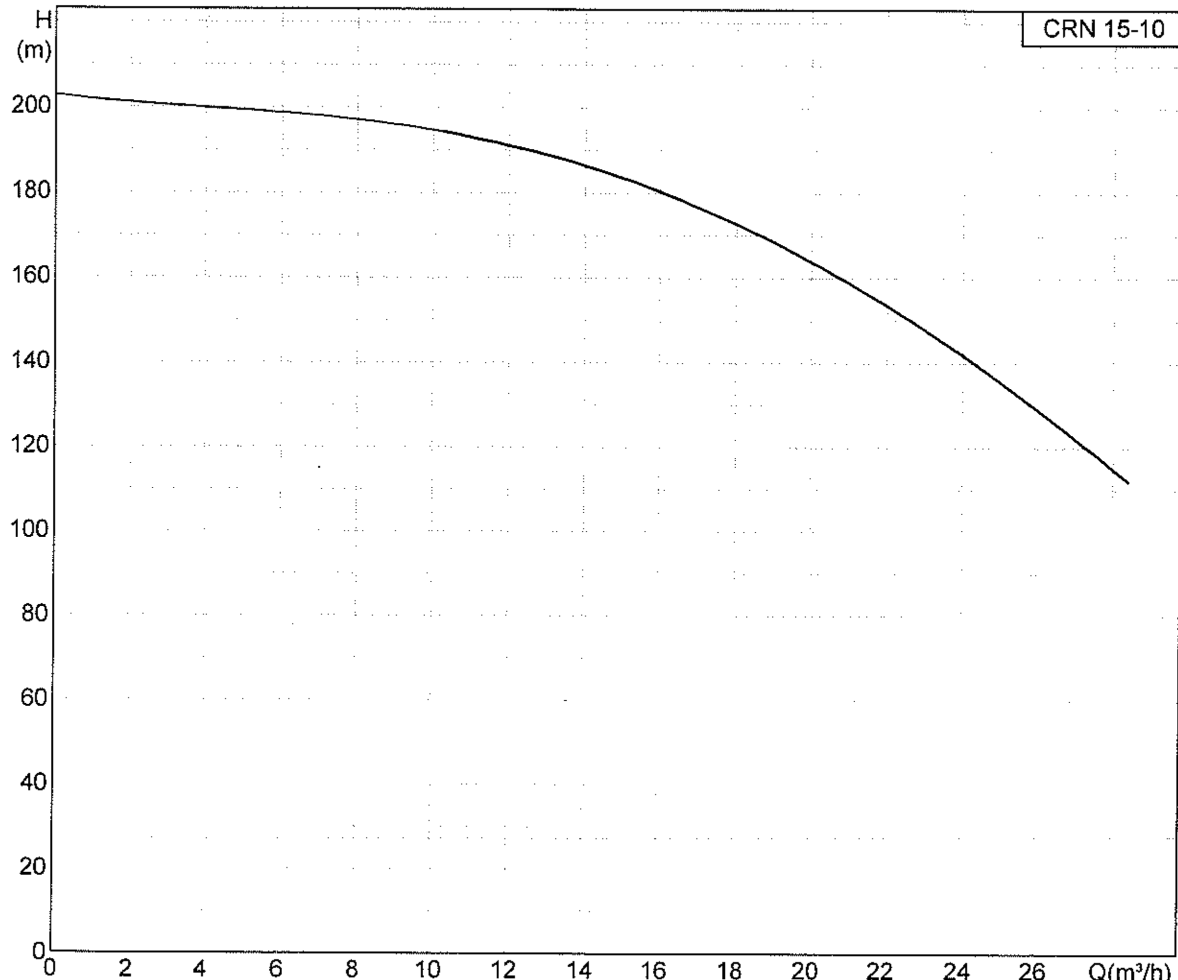
Installation:

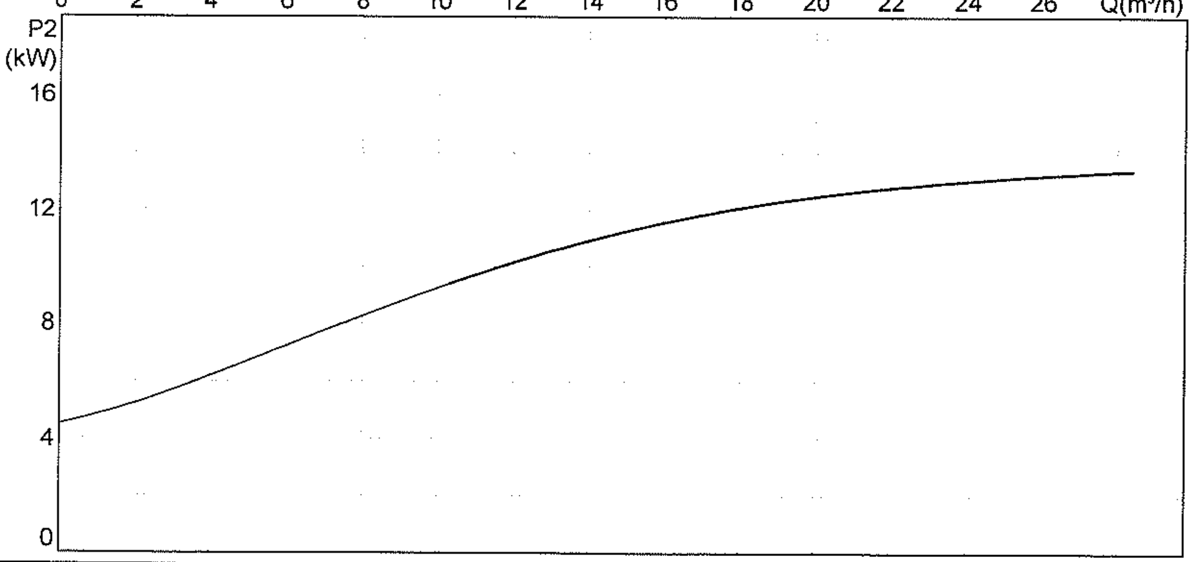
Maximum ambient temperature:	313 K
Max pressure at stated temp:	25 / 90 bar / °C

Position	Qty.	Description		Single Price
			25 / -20 bar / °C	
		Flange standard:	PJE (Victaulic)	
		Pipe connection:	2 3/8"	
		Flange size for motor:	254TC	
		Electrical data:		
		Motor type:	254TC	
		Number of poles:	2	
		Rated power - P2:	15 kW	
		Power (P2) required by pump:	15 kW	
		Mains frequency:	60 Hz	
		Rated voltage:	3 x 230 / 460 V	
		Rated speed:	3525 rpm	
		Enclosure class (IEC 34-5):	IP23	
		Insulation class (IEC 85):	B	
		Others:		
		Net weight:	128 kg	
		Shipping volume:	0.34 m³	

Company name:	-
Created by:	-
Phone:	-
Fax:	-
Date:	-

96523510 CRN 15-10

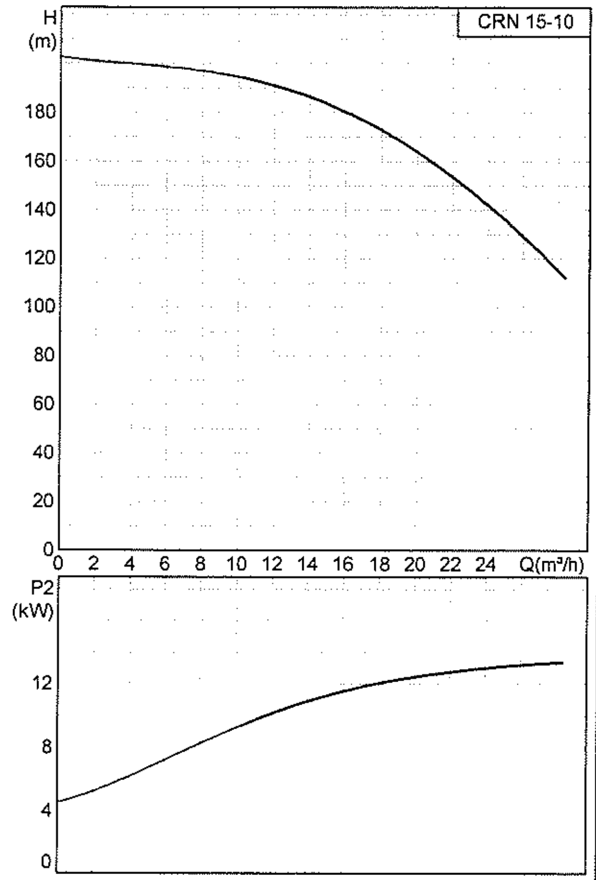




GRUNDFOS

Company name:	-
Created by:	-
Phone:	-
Fax:	-
Date:	-

Description	Value
Product name:	CRN 15-10 A-P-G-V HQQV
Product No:	96523510
EAN number:	5700396906140
Technical:	
Speed for pump data:	3497 rpm
Rated flow:	20.5 m³/h
Rated head:	162 m
Impellers:	10
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A
Stages:	10
Pump version:	A
Model:	A
Cooling:	ODP
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	V
Installation:	
Maximum ambient temperature:	313 K
Max pressure at stated temp:	25 / 90 bar / °C 25 / -20 bar / °C
Flange standard:	PJE (Victaulic)
Connect code:	P
Pipe connection:	2 3/8"
Flange size for motor:	254TC
Liquid:	
Liquid temperature range:	253 .. 363 K
Electrical data:	
Motor type:	254TC
Number of poles:	2
Rated power - P2:	15 kW
Power (P2) required by pump:	15 kW
Mains frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated speed:	3525 rpm
Enclosure class (IEC 34-5):	IP23
Insulation class (IEC 85):	B
Motor protec:	NONE
Motor No:	84Z03374
Others:	
Net weight:	128 kg
Shipping volume:	0.34 m³



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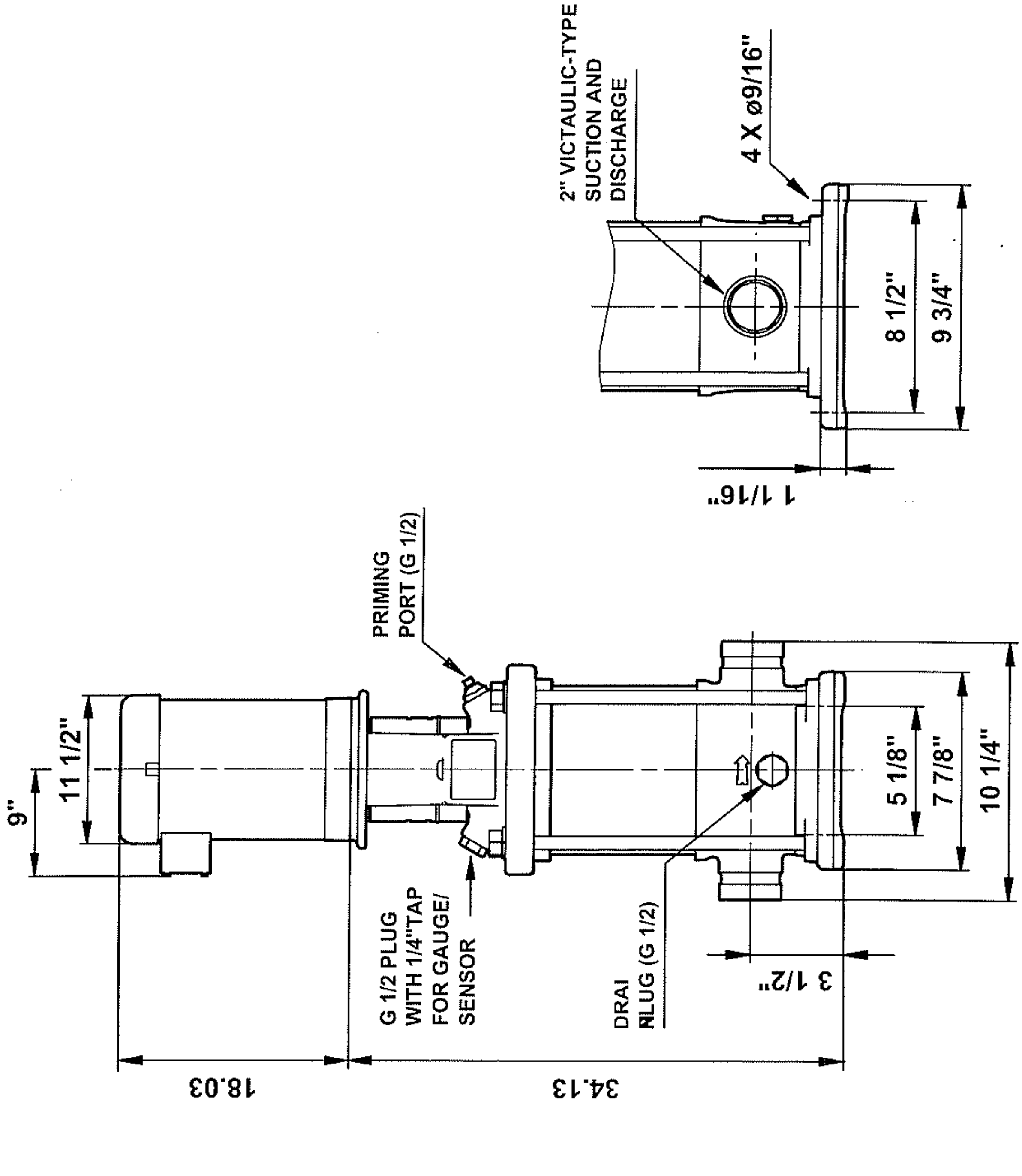
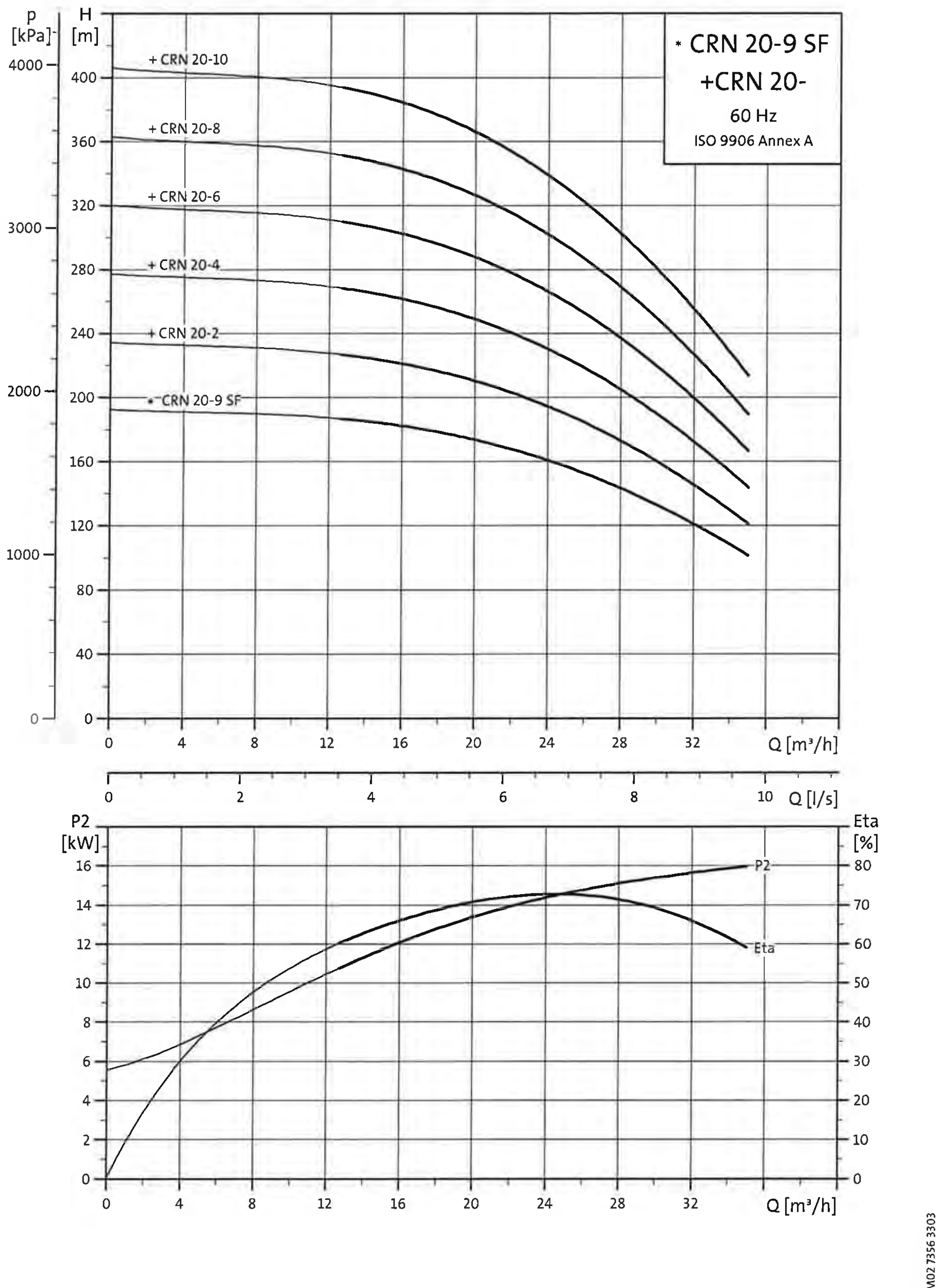
96523510 CRN 15-10



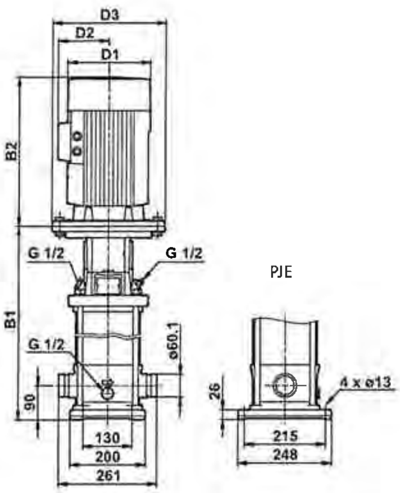
Note! All units are in [mm] unless others are stated.

Performance curves



Technical data

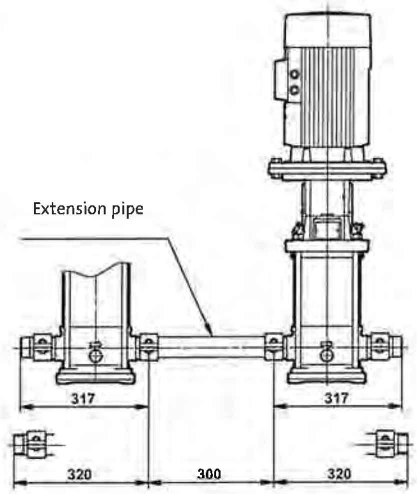
Dimensional sketches



TM02 7380 3303

Dimensions and weights

Pump type	Dimensions [mm]						Net weight [kg]
	B1	B2	B1 + B2	D1	D2	D3	
CRN 20-2	417	372	789	220	134	-	61
CRN 20-4	539	391	930	220	134	300	87
CRN 20-6	706	464	1170	260	172	352	120
CRN 20-8	796	478	1274	306	197	352	138
CRN 20-10	886	478	1364	306	197	352	151
CRN 20-9 SF	887	478	1365	319	197	350	146



TM02 7381 3303

Electrical data

3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor P_2 [kW]	Full load current $I_{1/1}$ [A]	Power factor Cos φ 1/1	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$
CRN 20-2	4.0	13.6-11.4/7.85-6.60	0.92-0.85	86.0-87.0	8.00-12.0
CRN 20-4	7.5	25.5-22.6/14.6-13.0	0.92-0.80	87.5-89.0	9.50-11.6
CRN 20-6	11.0	38.0-32.5/22.0-18.8	0.92-0.86	89.0-91.0	6.80-8.60
CRN 20-8	15.0	48.8-41.0/28.1-23.7	0.91-0.86	90.0-92.0	5.40-9.15
CRN 20-10	18.5	58.7-56.8/34.0-32.8	0.87	91.0-93.0	6.0-7.9
CRN 20-9 SF	18.5	58.7-56.8/34.0-32.8	0.87	91.0-93.0	6.0-7.9

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	Count	Description	Unit price
	1	**CRN 20-10 A-P-G-V HQQV**	On request

Product No.: 96524111
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:

- Impellers, intermediate chambers and outer sleeve are made of

Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr..

- Pump head cover and base are made of

Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr..

- The shaft seal has assembly length according to DIN 24960.
- Power transmission is via cast iron split coupling.
- Pipework connection is via PJE (Victaulic) flanges/couplings.

The motor is a 3-phase AC motor.

Liquid:

Liquid temperature range:	-4 .. 194 °F

Technical:

Speed for pump data:	3521 rpm
Rated flow:	111.4 US GPM
Rated head:	561 ft
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Installation:

Maximum ambient temperature:	104 °F
Max pressure at stated temp:	363 / 194 psi/°F 363 / -4 psi/°F
Flange standard:	PJE (Victaulic)
Pipe connection:	2 3/8"
Flange size for motor:	284TC

Electrical data:

Motor type:	286TSC
Efficiency class:	S
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz

GRUNDFOS

Company name:	-
Created by:	-
Phone:	-
Fax:	-
Date:	-

Position	*Count*	*Description*	*Unit price*
		Rated voltage: 3 x 230 / 460 V	
		Rated current: 57 / 28.5 A	
		Rated speed: 3525 rpm	
		Motor efficiency at full load: 91.7 %	
		Others:	
		Net weight: 364 lb	
		Shipping volume: 12 ft³	

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	*Count*	*Description*	*Unit price*
	1	**CRN 20-10 A-P-G-V HQQV**	On request

Product photo could vary from the actual product

Product No.: 96524111
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:
- Impellers, intermediate chambers and outer sleeve are made of

Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr..
- Pump head cover and base are made of

Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr..
- The shaft seal has assembly length according to DIN 24960.
- Power transmission is via cast iron split coupling.
- Pipework connection is via PJE (Victaulic) flanges/couplings.

The motor is a 3-phase AC motor.

Liquid:

Liquid temperature range:	-4 .. 194 °F

Technical:

Speed for pump data:	3521 rpm
Rated flow:	111.4 US GPM
Rated head:	561 ft
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Position	Count	Description	Unit price

Installation:

Maximum ambient temperature:	104 °F
Max pressure at stated temp:	363 / 194 psi/°F
	363 / -4 psi/°F
Flange standard:	PJE (Victaulic)
Pipe connection:	2 3/8"
Flange size for motor:	284TC

Electrical data:

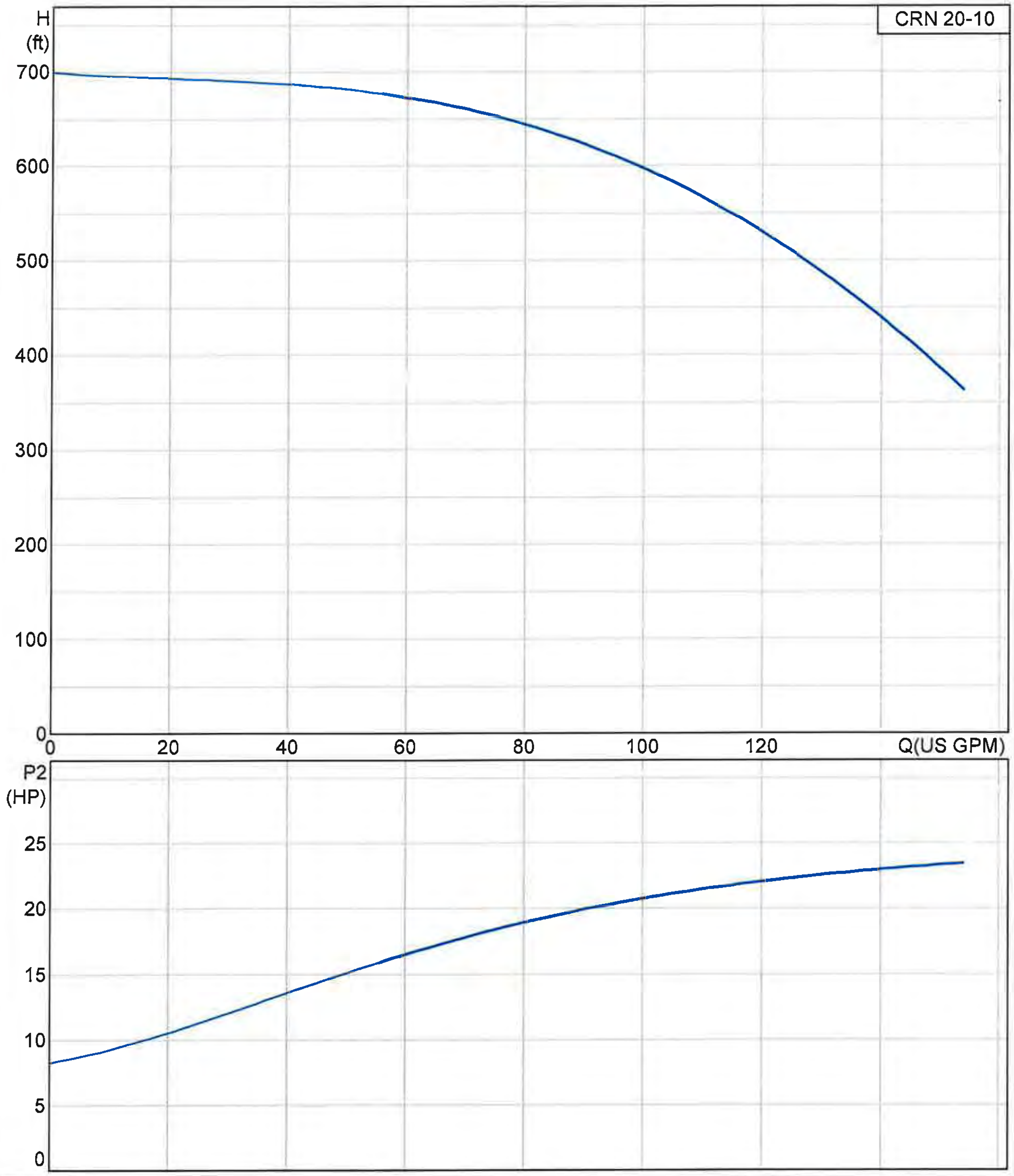
Motor type:	286TSC
Efficiency class:	S
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated current:	57 / 28.5 A
Rated speed:	3525 rpm
Motor efficiency at full load:	91.7 %

Others:

Net weight:	364 lb
Shipping volume:	12 ft^3

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

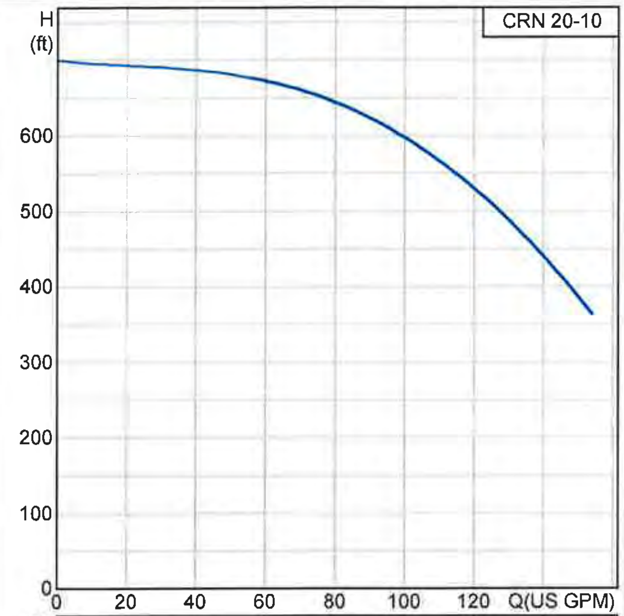
96524111 CRN 20-10

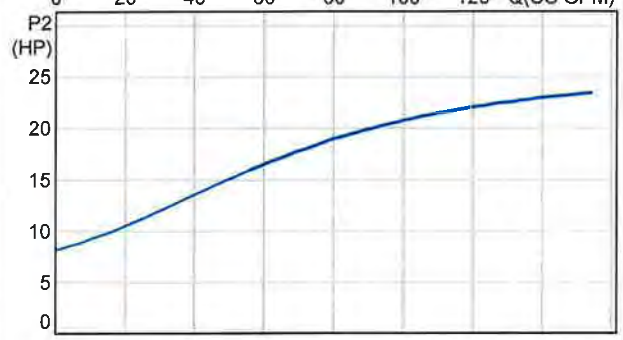


GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Description	Value
Product name:	CRN 20-10 A-P-G-V HQQV A-P-G-V HQQV
Product Number:	96524111
EAN number:	5700396917719
Technical:	
Speed for pump data:	3521 rpm
Rated flow:	111.4 US GPM
Rated head:	561 ft
Impellers:	10
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A
Stages:	10
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	V
Installation:	
Maximum ambient temperature:	104 °F
Max pressure at stated temp:	363 / 194 psi/°F 363 / -4 psi/°F
Flange standard:	PJE (Victaulic)
Connect code:	P
Pipe connection:	2 3/8"
Flange size for motor:	284TC
Liquid:	
Liquid temperature range:	-4 .. 194 °F
Electrical data:	
Motor type:	286TSC
Efficiency class:	S
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated current:	57 / 28.5 A
Rated speed:	3525 rpm
Motor efficiency at full load:	91.7 %
Motor protection:	NONE
Motor Number:	85600026
Others:	
Net weight:	364 lb
Shipping volume:	12 ft³





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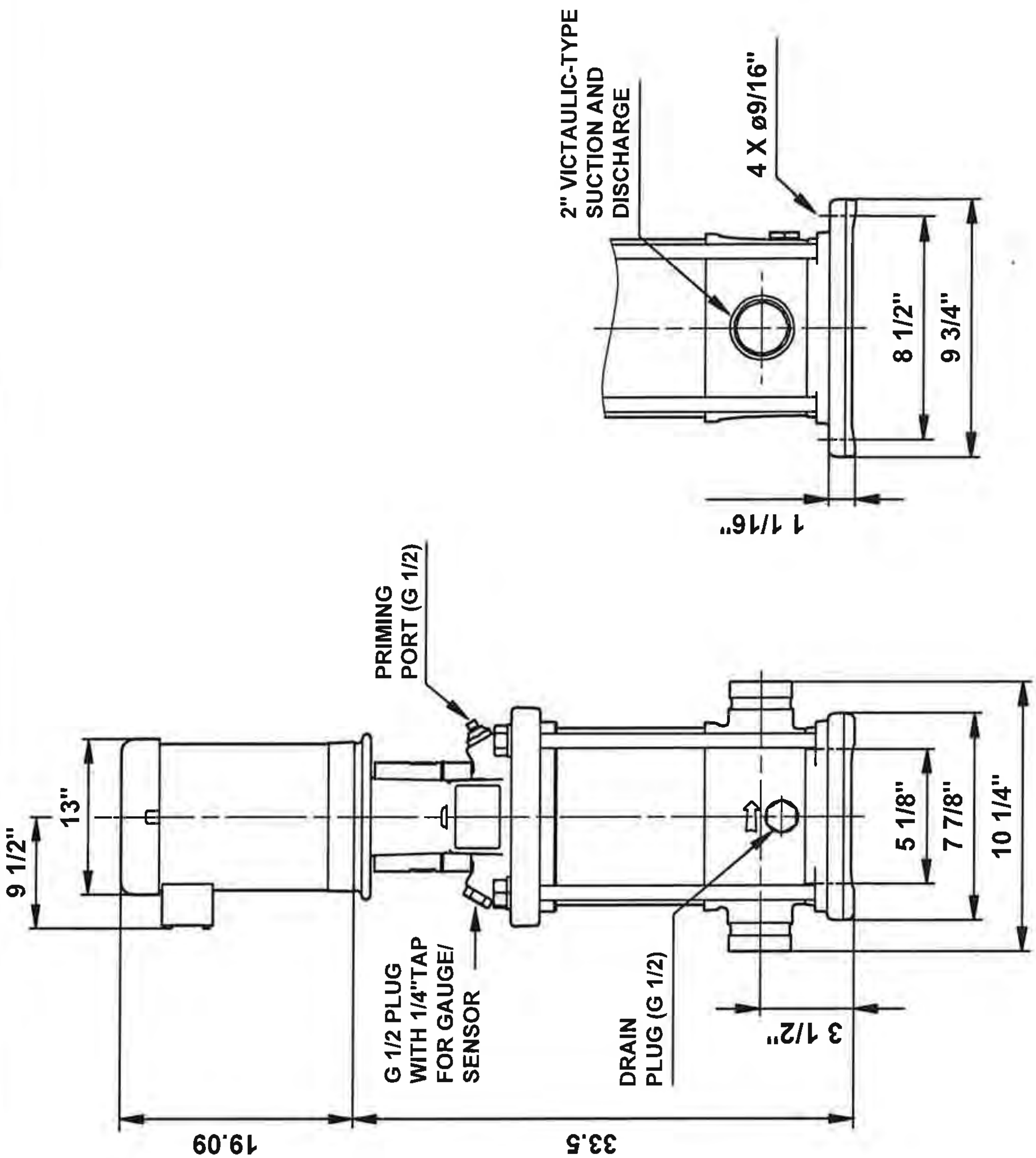
96524111 CRN 20-10



All units are [mm] unless otherwise presented.

Company name:	-
Created by:	-
Phone:	-
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Date:	-

Position	*Count*	*Description*	*Unit price*
	1	**CRN 20-9 SF SF-P-G-E HQQE** Product No.: 96512264	On request

Vertical, non-self-priming high-pressure pump with inline suction and discharge ports of identical diameter and reverse hydraulics and flow direction (high-pressure version).
Pump hydraulics consisting of base, pump head of lost-wax cast stainless steel and stainless steel impellers with floating PTFE neck rings.

Base and pump head are connected by means of stay bolts and a stainless steel sleeve.

Motor and pump shafts are connected via a balanced 2 piece coupling. Hard wearing cartridge shaft seal for easy replacement. Pumps of 15 hp and up with spacer coupling.

Surface-cooled 3-phase motor with power and main dimensions according to DIN/IEC.

Liquid:

Liquid temperature range:	-22 .. 248 °F

Technical:

Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Installation:

Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC
Flange standard:	PJE
Pipe connection:	60,1 mm
Flange size for motor:	FF300

Electrical data:

Motor type:	160L
Efficiency class:	1
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 380-480 D / 660-690 Y V
Rated current:	34,0-26,5 / 19,6-18,4 A
Starting current:	580-880 %
Cos phi - power factor:	0,93-0,92
Rated speed:	3510-3550 rpm

Position	Count	Description		Unit price
		Motor efficiency at full load:	89,0-91,0 %	
		Motor efficiency at 3/4 load:	90,0-90,5 %	
		Enclosure class (IEC 34-5):	IP55	
		Insulation class (IEC 85):	F	
		Others:		
		Net weight:	322 lb	

			Company name: -
			Created by: -
			Phone: -
			Fax: -
			Date: -

Position	***Count***	***Description***	***Unit price***
	1	**CRN 20-9 SF SF-P-G-E HQQE**	On request

Product photo could vary from the actual product

Product No.: 96512264

Vertical, non-self-priming high-pressure pump with inline suction and discharge ports of identical diameter and reverse hydraulics and flow direction (high-pressure version).
Pump hydraulics consisting of base, pump head of lost-wax cast stainless steel and stainless steel impellers with floating PTFE neck rings.

Base and pump head are connected by means of stay bolts and a stainless steel sleeve.

Motor and pump shafts are connected via a balanced 2 piece coupling. Hard wearing cartridge shaft seal for easy replacement. Pumps of 15 hp and up with spacer coupling.

Surface-cooled 3-phase motor with power and main dimensions according to DIN/IEC.

Liquid:

Liquid temperature range:	-22 .. 248 °F

Technical:

Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

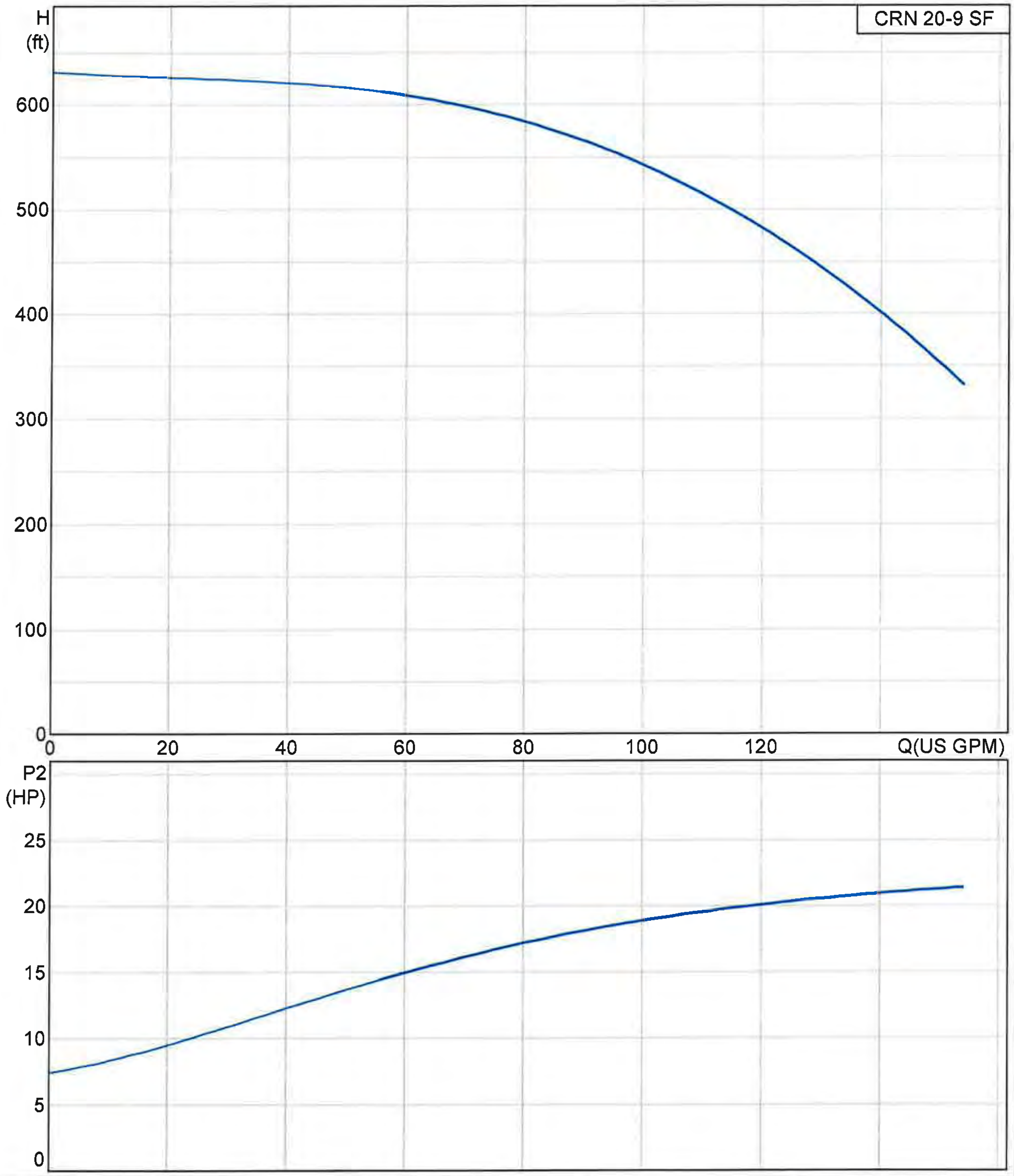
Installation:

Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC

Position	Count	Description		Unit price
		Flange standard:	PJE	
		Pipe connection:	60,1 mm	
		Flange size for motor:	FF300	
		Electrical data:		
		Motor type:	160L	
		Efficiency class:	1	
		Number of poles:	2	
		Rated power - P2:	25 HP	
		Power (P2) required by pump:	25 HP	
		Main frequency:	60 Hz	
		Rated voltage:	3 x 380-480 D / 660-690 Y V	
		Rated current:	34,0-26,5 / 19,6-18,4 A	
		Starting current:	580-880 %	
		Cos phi - power factor:	0,93-0,92	
		Rated speed:	3510-3550 rpm	
		Motor efficiency at full load:	89,0-91,0 %	
		Motor efficiency at 3/4 load:	90,0-90,5 %	
		Enclosure class (IEC 34-5):	IP55	
		Insulation class (IEC 85):	F	
		Others:		
		Net weight:	322 lb	

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

96512264 CRN 20-9 SF



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Company name: -
Created by: -
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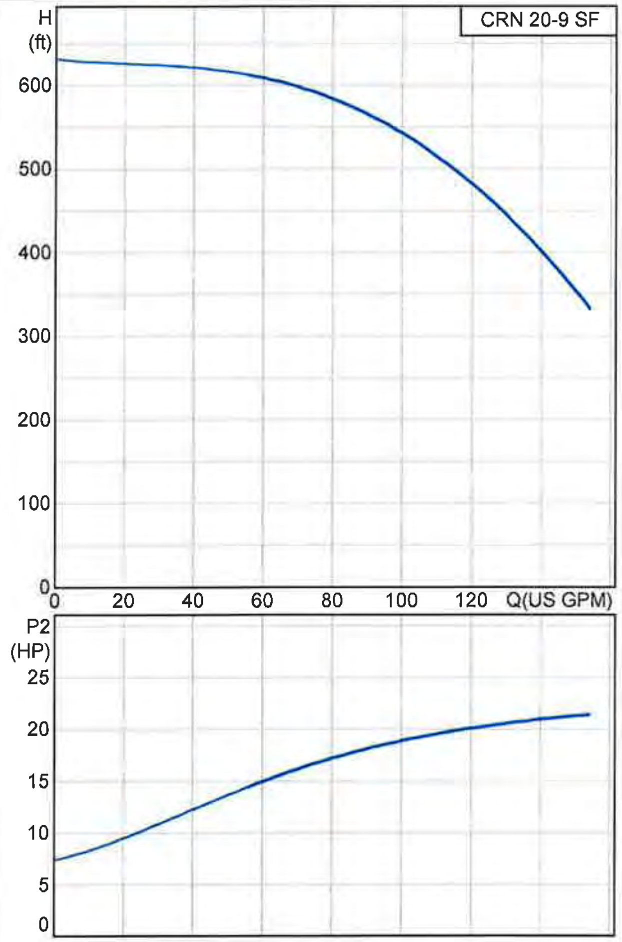
Fax: -
Date: -

Description	Value
Product name:	CRN 20-9 SF SF-P-G-E HQQE SF-P-G-E HQQE
Product Number:	96512264
EAN number:	5700396600505
Technical:	
Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Impellers:	09
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A
Stages:	09
Pump version:	SF
Model:	A
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	E
Installation:	
Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC
Flange standard:	PJE
Connect code:	P
Pipe connection:	60,1 mm
Flange size for motor:	FF300
Liquid:	
Liquid temperature range:	-22 .. 248 °F
Electrical data:	
Motor type:	160L
Efficiency class:	1
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 380-480 D / 660-690 Y V
Rated current:	34,0-26,5 / 19,6-18,4 A
Starting current:	580-880 %
Cos phi - power factor:	0,93-0,92
Rated speed:	3510-3550 rpm
Motor efficiency at full load:	89,0-91,0 %
Motor efficiency at 3/4 load:	90,0-90,5 %
Enclosure class (IEC 34-5):	IP55
Insulation class (IEC 85):	F
Motor protection:	PTC
Motor Number:	96619111
Others:	
Net weight:	322 lb



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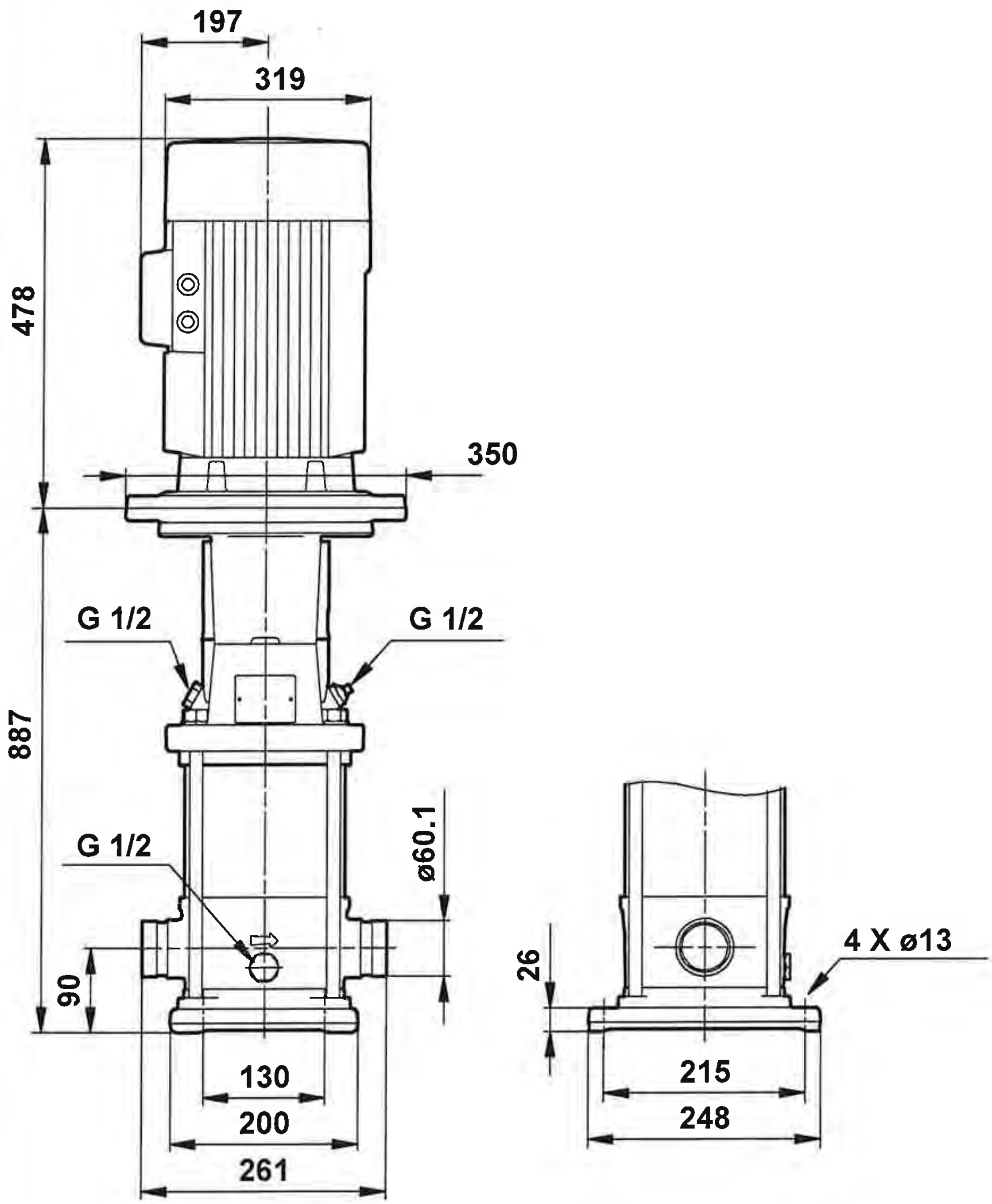
96512264 CRN 20-9 SF

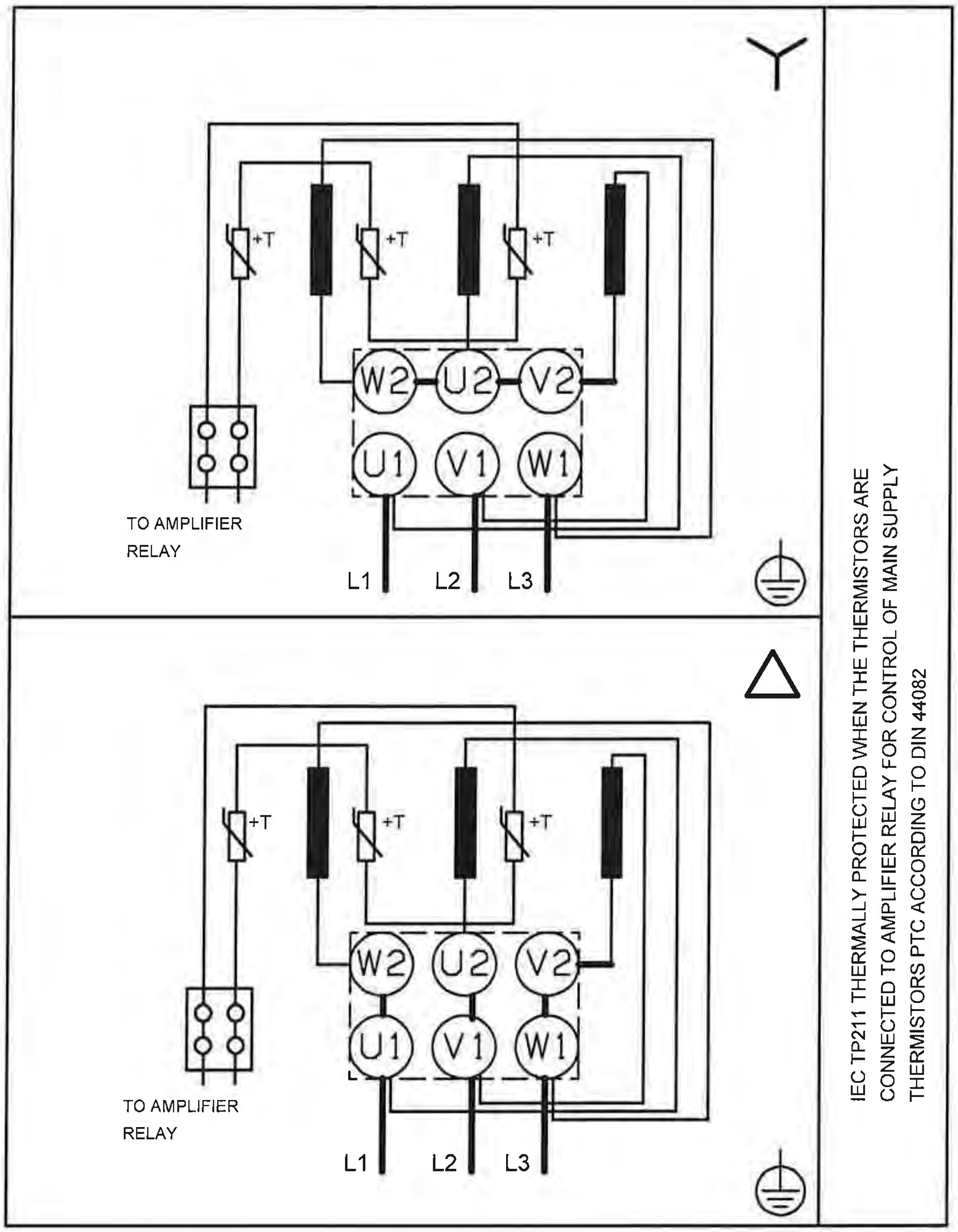


All units are [mm] unless otherwise presented.

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

96512264 CRN 20-9 SF



All units are [mm] unless otherwise presented.

BRAN+LUEBBE

ProCam^{MD} Diaphragm Metering Pumps

Superior Design – Exceptional Value, Fast Delivery

ProCam^{MD} diaphragm metering pumps set the standard for ease of operation and reliability in the medium duty chemical metering market. Precision metering for single point injection to 80 GPH (3,000 l/h) and up to 300 psi (20 bar) is now available in a Bran+Luebbe diaphragm pump at an incredible value.


DS15 with Stainless Steel Pumphead

Applications

The ProCam^{MD} is the best in class in the medium duty market. Including…

- Chemical
- Food & Beverage
- Pulp & Paper
- Utilities
- Water Treatment
- …and many more

Advantages

Economical Pumping of All Types of Liquids

- Unique double diaphragm design provides superior service life.
- Diaphragm monitoring system signals the onset of diaphragm wear.
- Metered liquid is protected from contamination by packing wear or pump lubricant.
- Adjustments to the pumphead are not required.
- Leak free, hermetically sealed fluid end.

Features

Metering Pumphead Design

- Mechanically actuated PTFE double-diaphragm.
- Diaphragm condition monitoring system with pressure gauge or optional pressure switch.
- Materials of construction:
  - 316 Stainless Steel
  - Alloy 20
  - PVC
  - PVDF (Kynar)

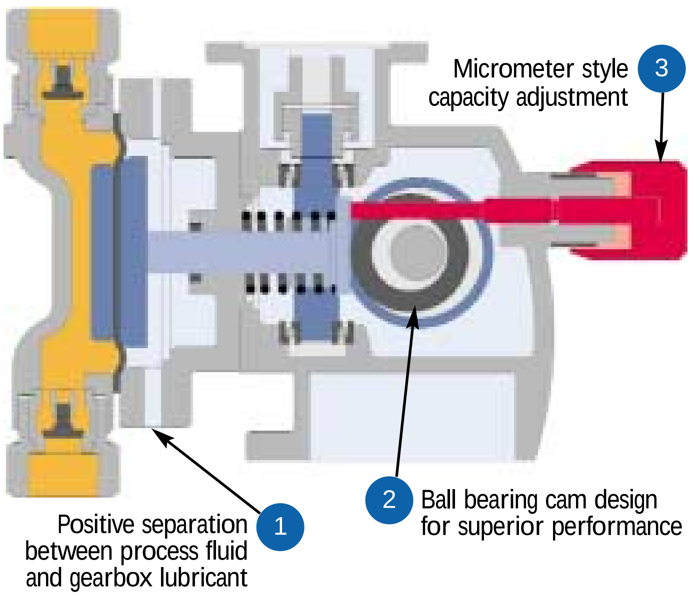
Robust Gear Technology

- Proven cam/spring design for long operating life.
- Linear stroke length adjustment.
- Rugged cast iron construction with bearing guided cam and shaft.

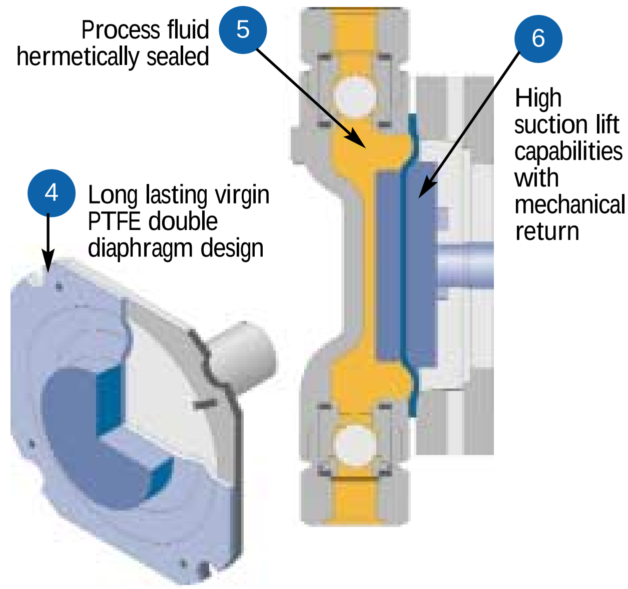
Motor

- 1/3 up to 1 HP TEFC 56C NEMA frame. (0.25 or 0.75 kw TEFC (IP54) IEC)
- Single phase or three phase voltage.
- Variable speed available as an option.

ProCam[MD]: Mechanically Actuated Diaphragm Pumphead with Simple Drive Operation.



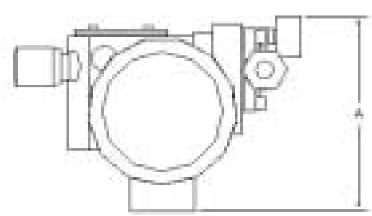
Standard Double Diaphragm Pumphead Design

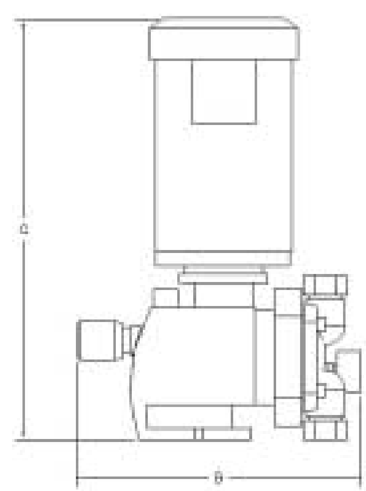


TECHNICAL DATA

Pump Type	Capacity in GPH* per stroke speed**				Connection	Max. Press	Materials of Construction	Dimensions			Approx. Wts.
	64	94	127	188	NPTF	PSIG		A	B	C	LBS.
DS 15	1.8	2.7	3.6	5.4	3/8”	300	316SS/Alloy 20	7.87”	12.25”	19.5”	40
DP 15						150	PVC/PVDF		12.87”		37
DS 50	6	9	12	18	3/8”	150	316SS/Alloy 20	8”	11.87”	19.5”	40
DP 50							PVC/PVDF		12.87”		37
DS 200	27	40	54	80	1/2”	175	316SS/Alloy 20	9.25”	13.5”	19.5”	65
DP 200						150	PVC/PVDF		16”	20.5”	64

* Note: Values at 100% volumetric efficiency.
** At 64 & 94 spm, motor RPM is 1750.
** At 127 & 188 spm, motor RPM is 3500.





TECHNICAL DATA

Pump Type	Capacity in LPH* per stroke speed**				Connection	Max. Press	Materials of Construction	Dimensions mm			Approx. Wts.
	50	72	100	144	mm	BAR		A	B	C	KG
DS 15	5.3	7.8	10.6	15.6	9	20	316SS/Alloy 20	200	311	495	18
DP 15						10	PVC/PVDF		327		16.8
DS 50	17.5	26	35	52	9	10	316SS/Alloy 20	203	302	495	18
DP 50							PVC/PVDF		327		16.8
DS 200	79	115	158	230	13	12	316SS/Alloy 20	235	343	495	29.5
DP 200						10	PVC/PVDF		406	521	29

* Note: Values at 100% volumetric efficiency.
** At 50 & 72 spm, motor RPM is 1400.
** At 100 & 144 spm, motor RPM is 2800.

BRAN+LUEBBE

SPX Process Equipment

ProCam MD - Part Number Code

Model	Material	Ratio	Connection	Diaphragm Monitor	Motor Adapter	Motor	Ident Number
MD15-S	316ss	28:1	3/8" NPTF	gauge	56C	none	**MD015S28111-000**
MD15-S	316ss	19:1	3/8" NPTF	gauge	56C	none	**MD015S19111-000**
MD15-A	Alloy 20	28:1	3/8" NPTF	gauge	56C	none	**MD015A28111-000**
MD15-A	Alloy 20	19:1	3/8" NPTF	gauge	56C	none	**MD015A19111-000**
MD15-P	PVC	28:1	3/8" NPTF	gauge	56C	none	**MD015P28111-000**
MD15-P	PVC	19:1	3/8" NPTF	gauge	56C	none	**MD015P19111-000**
MD15-K	Kynar	28:1	3/8" NPTF	gauge	56C	none	**MD015K28111-000**
MD15-K	Kynar	19:1	3/8" NPTF	gauge	56C	none	**MD015K19111-000**
MD50-S	316ss	28:1	3/8" NPTF	gauge	56C	none	**MD050S28111-000**
MD50-S	316ss	19:1	3/8" NPTF	gauge	56C	none	**MD050S19111-000**
MD50-A	Alloy 20	28:1	3/8" NPTF	gauge	56C	none	**MD050A28111-000**
MD50-A	Alloy 20	19:1	3/8" NPTF	gauge	56C	none	**MD050A19111-000**
MD50-P	PVC	28:1	3/8" NPTF	gauge	56C	none	**MD050P28111-000**
MD50-P	PVC	19:1	3/8" NPTF	gauge	56C	none	**MD050P19111-000**
MD50-K	Kynar	28:1	3/8" NPTF	gauge	56C	none	**MD050K28111-000**
MD50-K	Kynar	19:1	3/8" NPTF	gauge	56C	none	**MD050K19111-000**
MD200-S	316ss	28:1	1/2" NPTF	gauge	56C	none	**MD200S28111-000**
MD200-S	316ss	19:1	1/2" NPTF	gauge	56C	none	**MD200S19111-000**
MD200-A	Alloy 20	28:1	1/2" NPTF	gauge	56C	none	**MD200A28111-000**
MD200-A	Alloy 20	19:1	1/2" NPTF	gauge	56C	none	**MD200A19111-000**
MD200-P	PVC	28:1	1/2" NPTF	gauge	56C	none	**MD200P28111-000**
MD200-P	PVC	19:1	1/2" NPTF	gauge	56C	none	**MD200P19111-000**
MD200-K	Kynar	28:1	1/2" NPTF	gauge	56C	none	**MD200K28111-000**
MD200-K	Kynar	19:1	1/2" NPTF	gauge	56C	none	**MD200K19111-000**

Part Number Code:

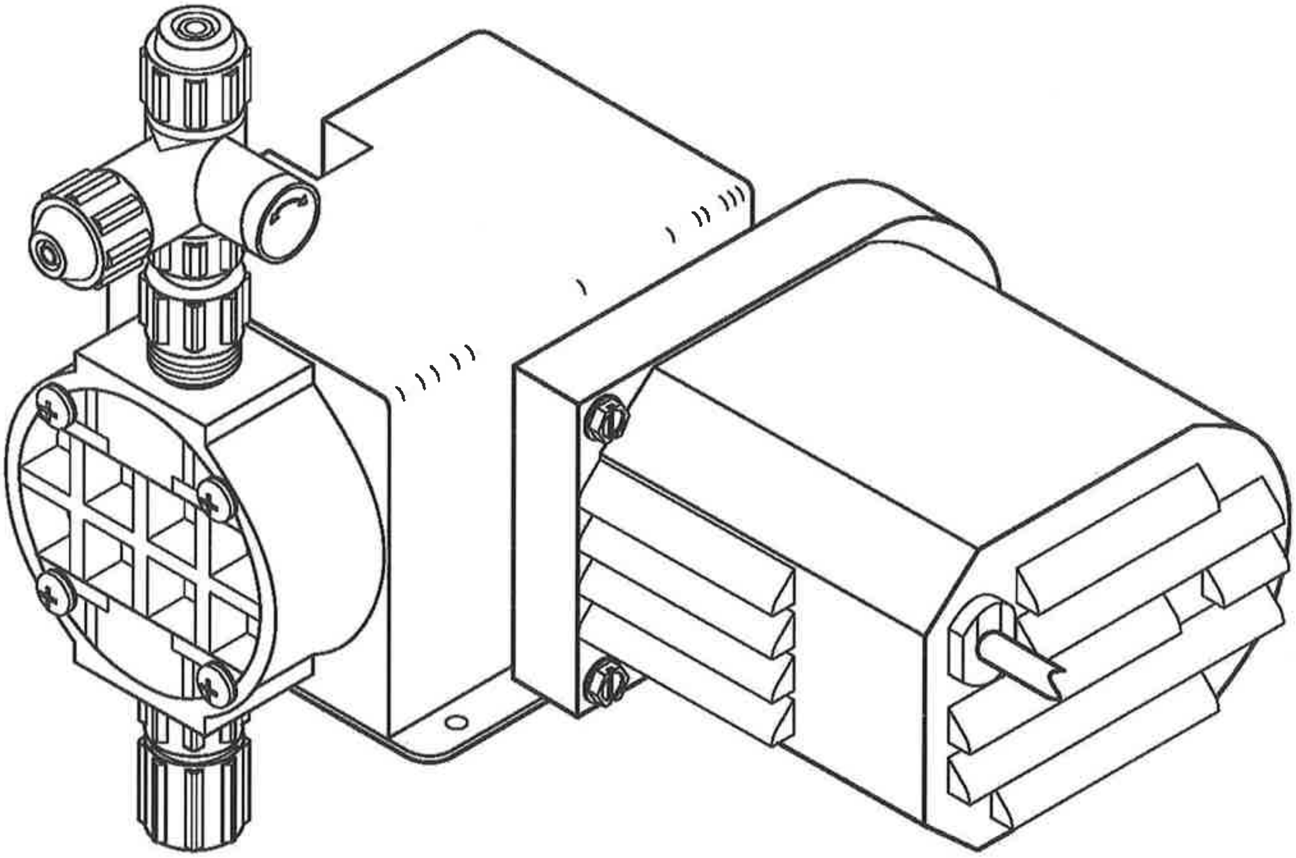
MD	**200**	**S**	**28**	**1**	**1**	**1**	**- 000**
Product	Size	Material	Ratio	Connection	Diaphragm Monitor	Motor Adapter	Motor (60 hz, TEFC)
MD	15 50 200	S = 316ss A = Alloy 20 P = PVC w/ EPDM K =PVDF w/ EPDM Y = PVC w/ FPM* Z= =PVDF w/ FPM*	28 = 28:1 19 = 19:1	0 = none 1 = NPTF	0=none 1=gauge 2=switch 3 = gauge & vent 4 = switch & vent	0=none 1 = 56C	000 = none 001 = 1/3hp, 1800rpm, 3ph 002 = 1/3hp, 1800rpm, 1ph 003 = 1/3hp, 3600rpm, 3ph 004 = 1/3hp, 3600rpm, 1ph 005 = 3/4hp, 3600rpm, 1ph 006 = 3/4hp, 1800rpm, 3ph 007 = 3/4hp, 1800rpm, 1ph 008 = 3/4hp, 3600rpm, 3ph 009 = 1hp, 1800rpm, 3ph 010 = 1hp, 1800rpm, 1ph 011 = 1hp, 3600rpm, 3ph 012 = 1hp, 3600rpm, 1ph

* Optional FPM O-rings and Teflon gaskets replace standard EPDM valve seals.

FPM = Viton

READ ALL CAUTIONS CAREFULLY BEFORE INSTALLING PUMP

SEE PAGE (4)



SERIES 100/150

INSTRUCTION MANUAL

P/N 32040
Rev B

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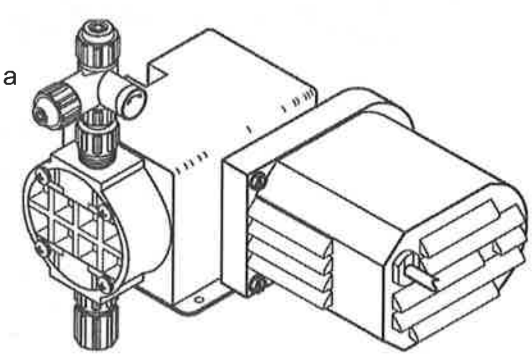
SAFETY INSTRUCTIONS

READ ALL INSTRUCTIONS PRIOR TO USE

⚠ DANGER Secure chemicals & metering pumps, making them inaccessible to children & pets.
*** **DO NOT PUMP FLAMMABLE LIQUIDS.**
*** Do not cut the plug or ground lug off the electrical cord. Consult a licensed electrician for proper installation or replacement.
⚠ WARNING To reduce the risk of electrical shock-before maintenance, repair, or moving, always disconnect the power to the pump by unplugging from wall outlet.
⚠ WARNING Always wear protective clothing, including gloves and safety glasses, when working on or near chemical metering pumps.
** Inspect tubing regularly for cracking or deterioration and replace as necessary. **(Always wear protective clothing and safety glasses when inspecting tubing.)**
** Use **CAUTION** to keep fingers away from rotating parts.
** If pump is exposed to direct sunlight, use a UV resistant tubing.
** Follow directions and warnings provided from the chemical manufacturer. The user is responsible for determining the chemical compatibility with the chemical feed pump.
** Make sure the voltage on the pump name tag matches the installation voltage. If pump fails to start, check line voltage.
** Consult with local health officials and/or qualified water conditioning specialists when treating potable water.
** Always depressurize system prior to installation or disconnecting the metering pump tubing.
** If injection point is lower than the chemical tank and pump, install an anti-siphon valve.
** **DO NOT MODIFY PUMP.** This poses a potentially dangerous situation and will void the warranty. Hand tighten plastic connections **(Do not use wrench)**.
⚠ CAUTION All pumps are factory tested with water. Remove tubing and thoroughly dry if the chemical being pumped will react with water (for example sulfuric acid).
* Hand tighten plastic connections **(Do not use wrench)**.
* Consult licensed plumber and electrician before installation to conform to local codes.
* **NOTE:** For accurate volume output, pump must be calibrated under all operating conditions.

INTRODUCTION



Series 100/150 are diaphragm-type metering pumps. A fluid is pumped from a chemical storage tank to the point of injection by the pulsing action of the diaphragm. The four check valves (top and bottom of pump head, strainer assembly, and injection assembly) keep the fluid flowing toward the point of discharge. To insure the solution being pumped can only go forward, it is important that all check valves provide positive, non-leaking backflow prevention. The wetted end (those parts that contact the solution being pumped) is constructed of SAN, PVC, TFE, Hypalon®, and polyethylene. These materials are very resistant to most chemicals. However, there are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as diaphragm, valve seat, or head. Alternate materials such as Viton®, polypropylene is available on request. Contact chemical supplier for chemical compatible materials.

■ MANUFACTURER'S PRODUCT WARRANTY

The manufacturer warrants its equipment of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for twenty-four (24) months from the date of purchase or one (1) year from date of installation or whichever comes first. The manufacturer's liability is limited to repair or replacement of any device or part which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through use of its products.

The above warranty is in lieu of any other warranty, either expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to make any warranty other than the above.

For warranty and service matters within the European Union, contact the seller first or:

Pulsafeeder, Inc. Europe
Units 12 and 13, Edison Road
Highfield Industrial Estates
Eastbourne, East Sussex BN23 6PT

PRECAUTIONS FOR OPERATION

Each Series 100/150 chemical feeder has been tested to meet prescribed specifications and certain safety standards. However, a few precautionary notes should be adhered to at all times. THOROUGHLY READ ALL CAUTIONS PRIOR TO INSTALLING METERING PUMP.

⚠ CAUTION

1. Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children and others. We cannot be responsible for the misuse of chemicals being fed by the pump.
2. Always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps.
3. Tampering with electrical devices can be potentially hazardous. Always place chemicals and feeder installation well out of the reach of children and others.
4. Be careful to check that the voltage of the installation matches the voltage indicated on the specification label. Each pump is equipped with a three prong plug. Whether plugging into a receptacle or wiring into a system, always be sure the feeder is grounded. If receptacle is utilized, to disconnect, do not pull wire but grip the plug with fingers and pull out.
5. Never repair or move the metering pump while operating. Always disconnect electrical current. Before handling the pump always allow sufficient time for the motor housing to cool off. Handling the pump too soon after shutdown may cause hand burns. For safety use protective gloves.
6. All pumps are pretested with water before shipment. Remove head and dry thoroughly if you are pumping a material that will react with water, (e.g. sulfuric acid). Valve seats, ball checks, gaskets, and diaphragm should also be dried. Before placing feeder into service, extreme care should be taken to follow this procedure.
7. Arrows on the pump head and injection fitting indicate chemical flow. When properly installed, these arrows should be pointing upward.
8. When metering hazardous material DO NOT use plastic tubing. Strictly use proper rigid pipe. Consult supplier for special adaptors.
9. **Pump is NOT to be used to handle or meter flammable liquids or materials.**

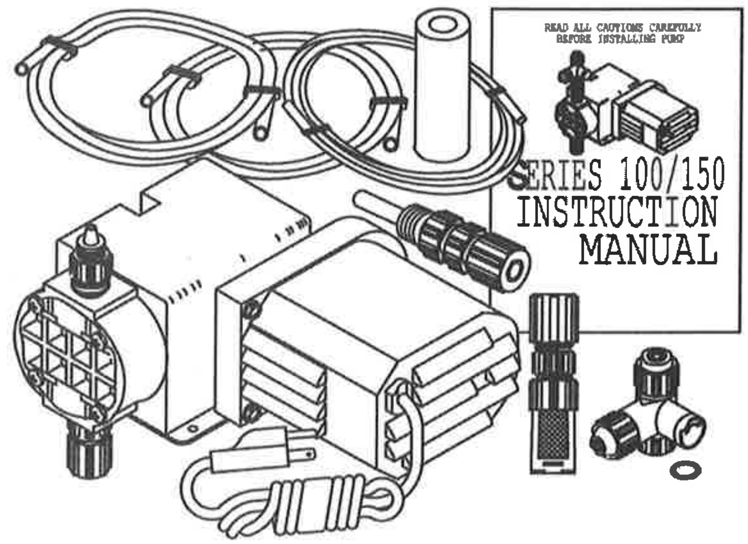
10. Standard white polyethylene discharge tubing is not recommended for installations exposed to direct sunlight. Consult supplier for special black polyethylene tubing.
11. Manufacturer will not be held responsible for improper installation of pumps, or local plumbing conducted. All cautions are to be read thoroughly prior to hook-up and plumbing. For all installations a professional plumber should be consulted. Always adhere to local plumbing codes and requirements.
12. Note the maximum pressure rating of the metering pump. When used with pressurized systems, always be sure the pressure of the system does not exceed maximum pressure rating listed on the specification label.
13. Be sure to depressurize system prior to hook-up or disconnection of metering pump.

INSTALLATION, PIPING AND WIRING

UNPACKING, ASSEMBLING AND MOUNTING:

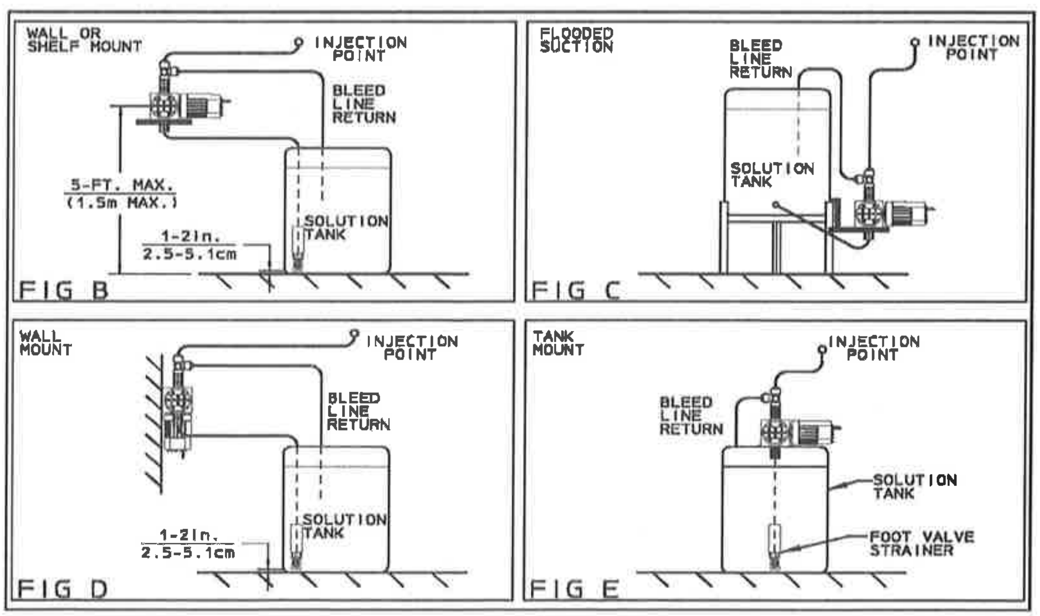
The carton should contain:

- Metering Pump
- 4 ft. (1.21 m) Clear Flexible Suction Tubing
- 4 ft (1.21 m) Stiff White Return Tubing
- Feeder can be mounted on a wall shelf bracket (Figure B), tank stand platform (Figure C), directly on the wall (Figure D), or directly on the tank cover (Figure E).
- Bleed Valve Assembly
- Instructions
- Strainer Assembly w/Tube Weight
- Back Check Valve Assembly
- 8 ft (2.43 m) Stiff White Discharge Tubing (Optional black tubing for UV protection available from the factory)



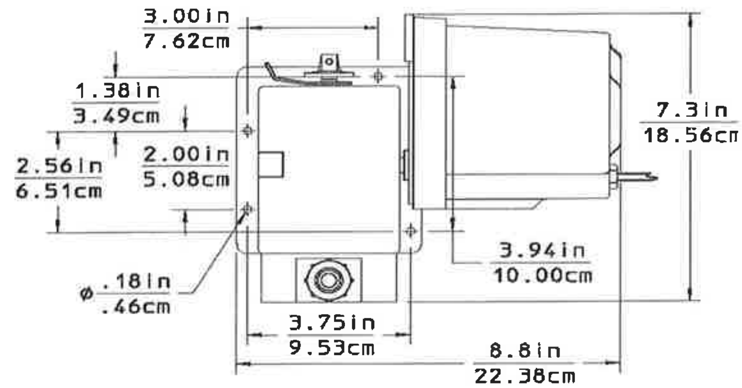
To mount the feeder directly on the wall, place the feeder base against the wall with the motor below the pumping head, remove four head mounting bolts, and turn head quarter turn so suction is in bottom position.

IMPORTANT: Injection point must be higher than top of solution tank to prohibit gravity feeding. Maximum head in meters is 70m/H$_2$O for Series 100 Model pumps and 42m/H$_2$O for Series 150 Model pumps.



NOTE: Make sure the arrow on the outside of the pump head is pointing upward. The pump must be positioned so that the plug is accessible.

Flooded suction mounting Fig. C (installing feeder at the base of tank on a platform) is the most trouble free type of installation. (Tank stands and platforms are available for all size feeders and tanks). The pump is secured on the platform, and then the clear suction tubing is attached to a bulkhead fitting assembly and the suction valve housing on the pump head. Since the suction tubing is always filled with solution, priming is accomplished much more quickly and the chance of losing prime on an installation where the feeder is used only a few hours a day, is greatly reduced. The feeder comes with a bleed valve assembly that attaches to the discharge valve in the pump head. The bleed valve allows you to manually prime the feeder and depressurize the discharge line without disconnecting the feeder from the tubing connections.



MOUNTING HOLE PATTERN

NOTE: To operate without bleed valve, replace bleed valve (item #49) and 0.38 in. (0.96 cm) -tubing size discharge valve housing (item # 42) with a 0.50 in. (1.27 cm) -tubing size discharge valve housing (item #42) and coupling nut (item #43). See page 12 (Wet End Assembly). Items #42 and #43 are available from factory.

Assemble tubing and fittings to the feeder (Fig. G).

⚠ CAUTION **Do not force fittings, HAND TIGHTEN ONLY. Do not use additional sealants, such as pipe tape, on tubing fittings. Use additional sealants, such as pipe tape, on pipe fittings and tighten normally.**

⚠ CAUTION If water is used to dissolve solid chemicals or create a dilute solution, the chemical tanks should be manually filled or an approved means must be used to prevent a cross connection between the chemical tank contents and the potable water line. Check local plumbing regulations.

CHEMICAL INJECTION:

Chemical injection into an open tank: The discharge tubing can be placed in an open tank with or without the injection valve assembly. Each feeder is shipped with a spring loaded back check injection valve. This assists in a positive seal on the discharge side of the pump head preventing back flow.

Pumps carrying the 'NSF' or the 'ETL Sanitation' (tested to NSF standard-50) approval are listed for swimming pools, spas, and hot tubs, and when proper materials are selected, are capable of handling but not limited to the following chemical solutions.

12 ^{1}/2% sodium hypochlorite 2% calcium hypochlorite 12% aluminum sulfate 10% hydrochloric acid 10% sodium hydroxide 5% sodium carbonate.

INSTALLATION INTO A WELL PUMP SYSTEM:

Make sure the voltage of the feeder matches the voltage of the well pump. Install the injection fitting into a tee which is installed into the water line going to the pressure tank. The end of the injection check valve should be in the main stream of the water line. A typical installation is shown in Figure H. **For installation of pump for operating swimming pools, pump is to be supplied by an isolating transformer or thru an "RCD" (residual current device).**

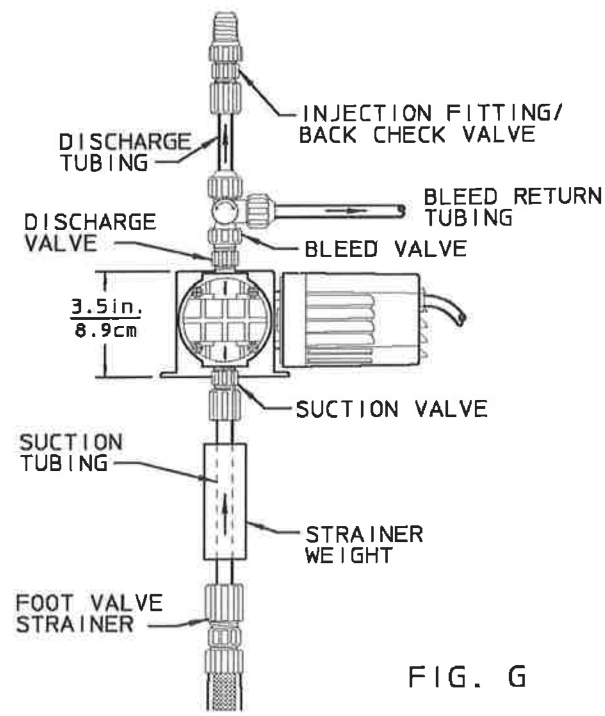


FIG. G

NOTE: It is recommended to install the injection assembly in a vertical position on the bottom side of the water line (Figure J).

This will insure proper sealing of the injection assembly check valve and prevent a back flow into the feeder's discharge line. Be sure arrow on injection fitting is pointing upward.

- **DOWN-THE-WELL INSTALLATION:**
Often it is desirable to provide chemical feed near the intake of the well pump for additional retention time and mixing of the chemicals. An additional length of discharge tubing will be required for this installation. Secure the end of the discharge tubing to the pump cylinder, drop pipe, or foot valve and lower it into the well. An anti-siphon valve must be installed on systems such as this where the discharge is lower than the feeder and the chemical storage tank.
Failure to install anti-siphon valve may allow siphoning to occur.

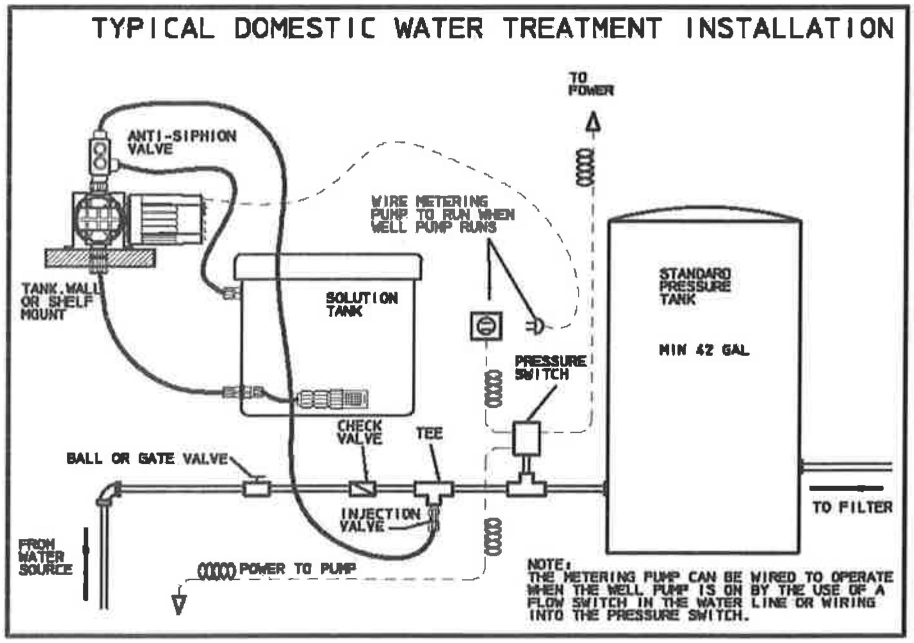


FIG. H

- **ANTI-SIPHON VALVE: (optional)**
Under any installation condition where the possibility of siphoning or suction may occur on the discharge side of the pump, install an anti-siphon valve on the discharge side of the feeder. The anti-siphon valve is not part of the standard package. This item can be furnished by your dealer at extra cost.

- **PRESSURE RELIEF VALVE: (optional)**
Series 100/150 chemical pumps are rated to pump against a line pressure up to 100 PSI (7 BAR). If the line pressure on an installation could fluctuate above 100 PSI (7 BAR), install a pressure relief valve on the discharge side of the pump head. Once the pressure reaches a certain level, the pre-set relief valve will return the solution being pumped back to the solution tank. This will prevent motor burnout or diaphragm rupture. The relief valve is not part of the standard package. This item can be furnished by your dealer at extra cost. Read relief valve instructions carefully before installing.

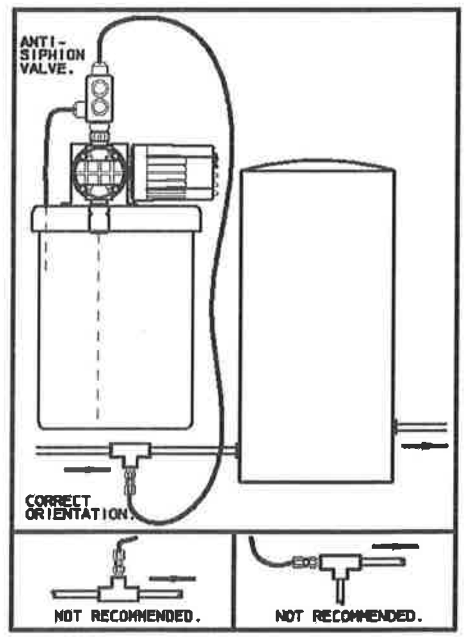
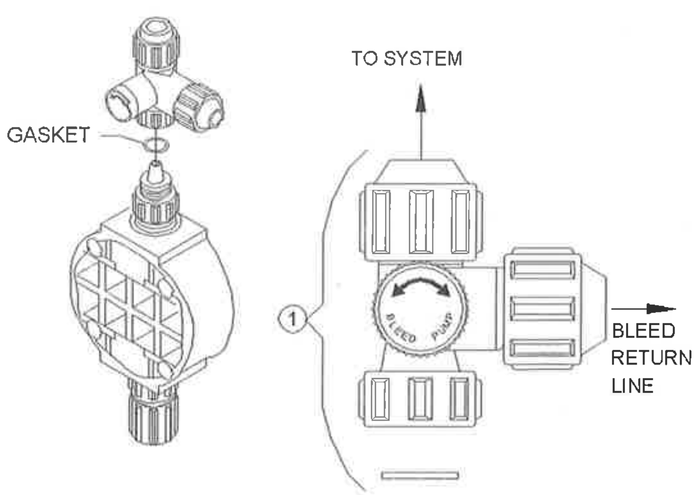


FIG. J

- **BLEED VALVE INSTALLATION: (optional)**

NOTE: After disconnecting power to the pump and taking necessary safety precautions regarding the chemical and system.

1. Remove the coupling nut and tubing from the discharge port of the pump.
2. Remove the valve housing from the discharge side of the pump head and replace it with the .38inch valve housing from the kit (this step is not required if the pump is already fitted for .38inch tubing.
3. Install the TFE gasket (ChemTech) over the discharge fitting.
4. Install the bleed valve assembly over the discharge fitting and gasket. (ChemTech)



5. Install the bypass tubing from the kit into the bypass port of the bleed valve and hand tighten the coupling nut. Bypass tubing should be connected to return bypassed liquid back to the solution tank.
6. Install the discharge tubing into the discharge port of the bleed valve and hand tightens the coupling nut.
7. Return the system to operating conditions and reconnect the power to the pump.
   The pump is now ready for priming and operation. Always use caution and check for leaks at newly assembled connections.

Air Bleed Operation:
1. While pump is running, turn the bleed valve knob counter clockwise.
2. Run with valve open until a solid stream of fluid comes out of the bypass tubing (.38inch tubing supplied with valve)
3. Close air bleed valve by turning the bleed valve knob clockwise.

- **HAND TIGHTEN FITTINGS:**

When connecting tubing to suction and discharge fittings, the coupling nuts should be tightened hand tight only. Excessive tightening can cause cracks in pump head.

- **POINT OF INJECTION:**

Pipe corrosion can result if dillution at the injection point does not occur rapidly. This problem is easily prevented by observing this simple rule: install injection fitting so that the end is in the flow stream of the line being treated. **NOTE:** Extended injection assemblies are available for large water lines. Consult your dealer.

- **COMMON ERRORS IN THE INJECTION OF CHEMICALS:**

Do not insert the injection fitting into a pipe stub in the tee. A full strength solution will often cause corrosion or scale in the pipe stub when it is not in the flowing stream (Figure J). The maximum lift of the chemical feeder is five feet. Be sure not to exceed this height. **It is very important that the arrow on the fittings and the pump head point vertically upward in order to prevent backflow.** Arrows indicate the proper flow of the chemical.

POWER

The standard chemical feeder is available in115 volt 60 cycle single phase. 230 volt 60 cycle and 230 volt 50 cycle single phase can also be made available upon request.

⚠ CAUTION **Be sure the voltage of the feeder matches the power supply.** (Figure M)

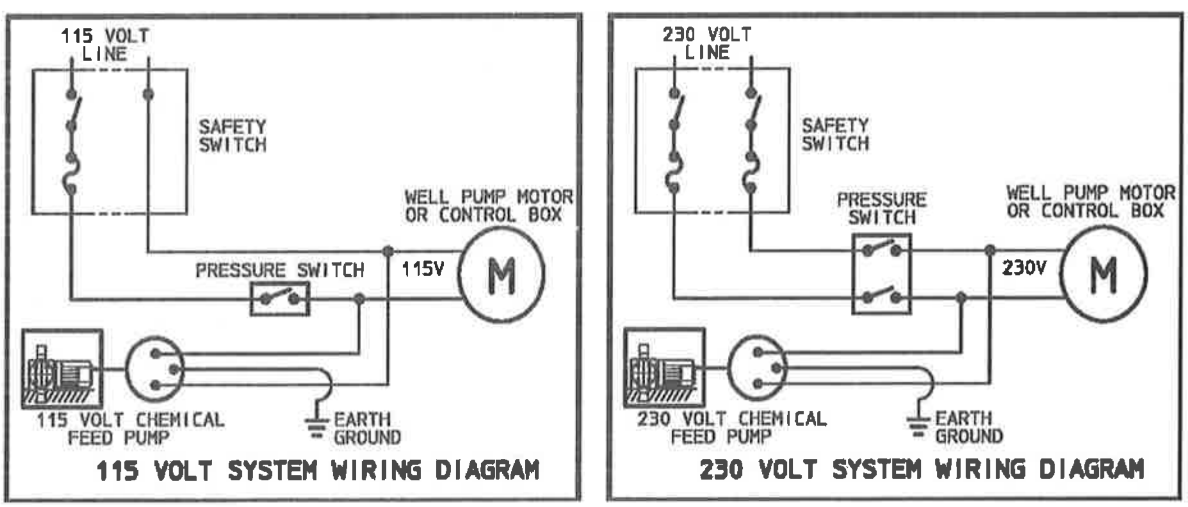


Figure M

When working on or around metering pump installation, protective gloves and safety glasses should be worn at all times.

▪ PRIMING

⚠ CAUTION **All pumps are tested with water (e.g. sulfuric acid, polymer) the pump head should be removed and dried thoroughly along with the diaphragm and valve seats.**

If the discharge line is connected directly to a pressurized system it should be temporarily bypassed during priming of the pump. This pump is equipped with a bleed valve to simplify this operation by allowing easy bypass of the discharge fluid.

All air must be purged from the pump head before the pump will pump against pressure. Turn on the power to the pump. Loosen the locking lever by turning it counter-clockwise and turn the output adjusting knob counter-clockwise to full capacity, (one full turn only) then tighten the locking lever by turning clockwise to a hand tight position. Solution should be primed to the head within a few minutes. (Refer to Figure K)

Air Bleed Operation: A) While pump is running, turn adjustment screw counterclockwise. B) Run with valve open until a solid stream of fluid comes out of the bypass tubing (0.25 in (0.63 cm) ID x 0.38 in (0.96 cm) OD) supplied with valve, no air bubbles. C) Close air bleed valve by turning adjustment screw clockwise.

NOTE: The feeder is adjustable only while running; never force the output adjustment knob. Do not turn the adjustment knob while the pump is stopped. If the solution hasn't reached the head in a few minutes, disconnect power to the pump, make sure the system is depressurized, remove the discharge tubing and discharge fitting and dampen the discharge valve area (ball check and valve seats) with a few drops of solution being fed by the pump. For safety, use protective gloves and safety glasses and a proper container to hold chemical. Replace the fitting and tubing and restart the pump.

Turn the power on once more and adjust the pump to the proper rate, using the locking lever as before.

⚠ CAUTION ***When working on or around metering pump installation, protective gloves and safety glasses should be worn at all times.***

⚠ CAUTION **Check calibration of the pump before leaving the installation site. A test for chemical residual in the treated water is the best indication of the correct pump setting.**

▪ MAINTENANCE:

▪ SCALE: GASKETS AND CHECK VALVES

When checking the metering pump or providing routine maintenance, replace all valve seats or ball checks if any of them show any wear or deterioration. (Valve seats should be checked approximately every 4-6 months depending upon the application.) Repeated deterioration of valve seats and other rubber or plastic parts within a few months period usually indicates another material should be used for the defective part. Contact your supplier or see the parts list for parts affected for possible alternate materials.

▪ OUTSIDE INSTALLATION:

In many areas where freezing conditions are not a problem it is common to install a metering pump outside. Adequate protection should be provided to keep the pump from being exposed to direct sunlight or rain. Any simple covering adequately ventilated will afford the necessary protection from weather. **NOTE:** When discharge tubing is exposed to direct sunlight, black polyethylene tubing should be used in lieu of the stiff white translucent tubing supplied with each pump.

▪ SOLUTION TANK:

Check the solution tank for settling of chemicals. If there is sludge on the bottom of the solution tank, clean the strainer, the foot valve, and the solution tank. Installing the foot valve a few inches above the bottom of the tank will prevent future clogging. **NOTE: If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (calcium hydroxide), mixers are readily available in different motor configurations and mountings.**

▪ OUTPUT ADJUSTING KNOB:

Sometimes the output adjusting knob can move on its shaft and cause a false output indication. This can happen if the knob set-screw slips or if the unit is disassembled for any reason. The unit can be reset to "0" as follows:

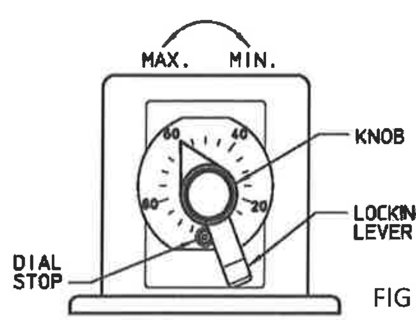


FIG K

1. Remove the dial stop.
2. With the pump running, loosen the locking lever and turn the adjusting knob counter-clockwise until it is "loose" to touch.
3. SLOWLY re-screw the knob clockwise, using very light finger pressure. It will soon start to advance in pulses as the internal cam comes in and out of contact.
4. When light finger pressure will no longer allow movement of the knob between cam contacts, grasp the knob securely and tighten the locking lever (turning clockwise) making sure that the knob does not move. To check for zero point, turn on pump. There should be no liquid coming out of discharge fitting.
5. Replace dial stop.

6. If the pointer is not at "0", loosen the set-screw on the knob (use a .078 in Hex key), and turn pointer to "0", then retighten the set-screw while holding the knob in place.

7. A setting of "0" will now give zero output. One full revolution of the knob counter clockwise will give maximum output. The knob should never be turned more than one full revolution.

SERVICING AND REPAIRS

⚠ CAUTION REPLACEMENT OF PUMP HEAD ASSEMBLY OR DIAPHRAGM:

Before performing any repairs on Series 100/150 chemical feeders, be sure to disconnect all electrical connections and relieve pressure from suction/discharge tubing.

The Series 100/150 feeder was designed so that servicing can be quick and simple. Proper part replacement procedures are described below.

NOTE: Use protective gloves and safety glasses when working on or around chemical feeder.

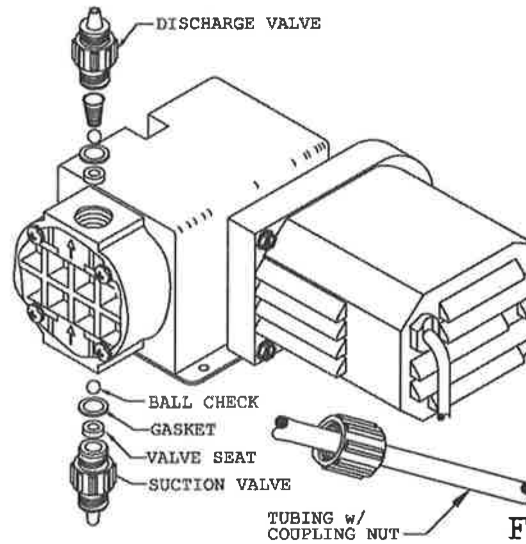


FIG. N

1. Disconnect the tubing. Remove the suction valve and discharge valve being careful not to lose the ball checks and any other small parts. (Figure N)
2. Remove the four screws from the face of the head and remove the head.
3. Remove the diaphragm by inserting one or two of the head bolts into the holes of the diaphragm and turning counter-clockwise. (Figure O)
4. A new pump head or diaphragm should be installed if either is broken or cracked (see parts list at the end of this manual). The new pump head can be installed by going through the above steps in reverse.
5. Be sure the drive bracket assembly is in the **fully retracted position** when installing the new diaphragm. Install the new diaphragm by screwing it in hand tight, then, back off one-fourth turn or until screw holes are lined up.
6. Replace the head and the head screws, being certain the discharge fitting is up. NOTE: Arrow on outside of pump head should be in vertical position pointing upward. Tighten the head screws evenly and carefully to prevent cracking the head.
7. Replace the suction and discharge fittings making sure all gaskets and valves are fitted properly. Do not use pipe tape or other sealants. **HAND TIGHTEN ONLY.** Restart the system as in the start up procedures (INSTALLATION).

BALL CHECKS AND VALVE SEAT REPLACEMENT:

The following procedure is the same for any of the four valves.

Make sure all electrical connections are disconnected and pressure valves off.

NOTE: Use protective gloves and safety glasses while replacing parts.

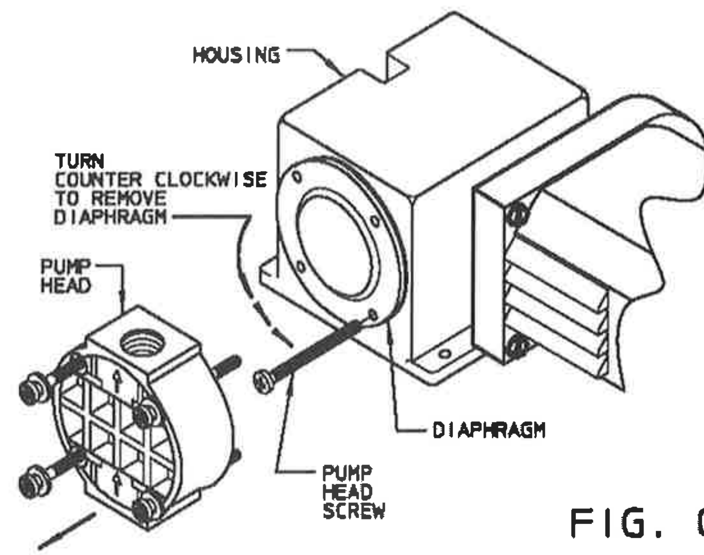


FIG. O

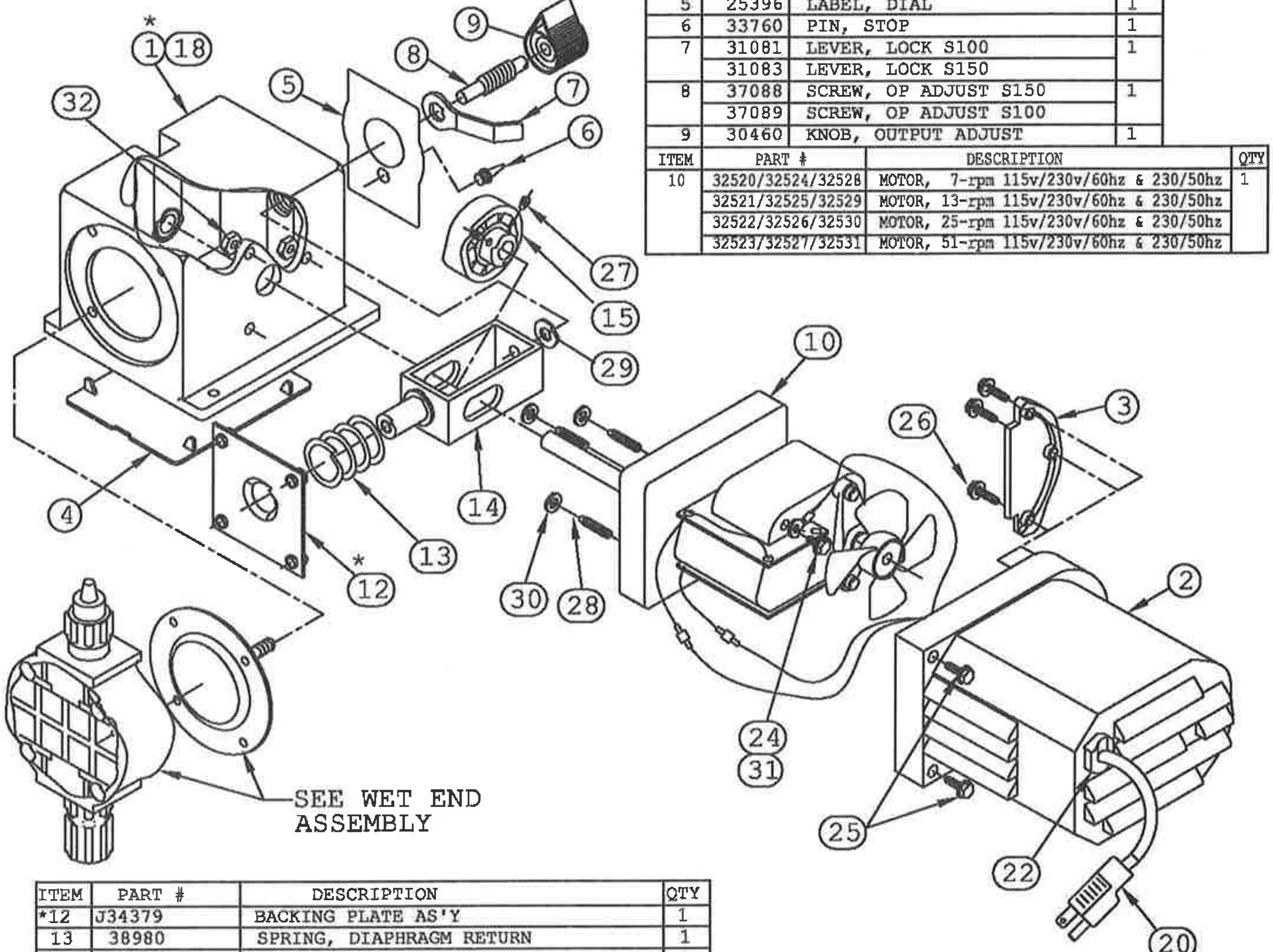
1. Unscrew compression nut and remove tubing.
2. Unscrew check valve body from pump head, foot valve, or injection fitting.
3. Remove all seats, ball checks, and gaskets and replace.
4. Replace the check valve body so fitting makes contact with the gasket and the pump head, foot valve or injection fitting, whichever the case may be. **HAND TIGHTEN FITTINGS ONLY.** Do not use pipe tape or other sealants on these threads.
5. Re-install the tubing and tighten coupling nut **HAND TIGHT.**
6. Restart the system as in the INSTALLATION PROCEDURES.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
LOSS OF CHEMICAL RESIDUAL	1. Pump setting too low. 2. Scale at injection point 3. Solution container allowed to run dry	1. Adjust to higher setting (feeder must be operating during the stroke length adjustment). 2. Clean injection parts with 8% muriatic acid or undiluted vinegar. 3. Refill the tank with solution and prime. See Start-Up Section
TOO MUCH CHEMICAL	1. Pump setting too high. 2. Chemical in solution tank too rich. 3. Siphoning of chemical into well or main line	1. Lower pump setting (pump must be operating to adjust the dial). 2. Dilute chemical solution. NOTE: For chemical that reacts with water, it may be necessary to purchase a more dilute grade of chemical direct from chemical supplier. 3. Test for suction or vacuum at the injection point. If suction exists, install an anti-siphon valve. See Figure G.
LEAKAGE AROUND TUBING CONNECTIONS	1. Worn tube ends 2. Chemical attack	1. Cut off end of tubing (about 1") and then slip on as before or replace suction valve housing and compression fitting to prevent leakage. 2. Consult your chemical supplier for compatible materials.
FAILURE TO PUMP OR FEED	1. Leak in suction side of pump. 2. Valve seats not sealing. 3. Low setting on pump. 4. Low solution level. 5. Diaphragm ruptured. 6. Pump head cracked or broken. 7. Pump head contains air or chlorine gas.	1. Examine suction tubing. If worn at the end, cut approximately an inch off and replace or replace valve body and coupling nut. 2. Clean valve seats if dirty or replace with proper material if deterioration is noted. 3. When pumping against pressure, the dial should be set above 40% maximum rated capacity for a reliable feed rate. 4. Solution must be above foot valve. 5. Replace diaphragm as shown in "Service" Section. Check for pressure above 100 PSI (7 BAR) at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head. 6. Replace pump head as shown in "Service" Section, Do not use pipe tape or other sealants. Make sure fittings hand tight only. Using pliers or wrench can crack pump head. Also, chemical incompatibility can cause cracking and subsequent leakage. 7. While pump is running, turn bleed valve adjustment screw counter-clockwise until air is purged. Close bleed valve.
PUMP LOSES PRIME	1. Dirty check valve. 2. Ball checks not seating or not sealing properly. 3. Solution container allowed to run dry	1. Remove and replace or clean off any scale or sediment. 2. Check seat and ball checks for chips, clean gently. If deformity or deterioration is noted, replace part with proper material. Chemical crystallization can hold check valves open, therefore the valves must be disassembled and cleaned. Be sure to replace all parts as shown in the Parts Diagram (at the end of the manual). 3. Refill the tank with solution and prime.
LEAKAGE AT FITTING	1. Loose fittings 2. Broken or twisted gasket 3. Chemical attack	1. All fittings can be hand tightened to prevent leakage. Clean off chemicals which have spilled on pump. 2. Check gaskets and replace if broken or damaged. 3. Consult your chemical supplier for compatible materials.
PUMP WILL NOT PRIME	1. Too much pressure at discharge 2. Check valves not sealing 3. Output dial not set at maximum	1. Open bleed valve and circulate fluid until all air is purged from pump head assembly. Close bleed valve. 2. Disassemble, loosen, clean and check for deterioration or swelling. Reassemble and wet the valve assembly, then prime. See INSTALLATION Section. 3. Always prime pump with output dial set at maximum rated capacity.
ANTI-SIPHON VALVE MALFUNCTION	1. Scale or particles have plugged diaphragm 2. Ruptured valves	1. Remove, clean and reassemble, being careful not to wrinkle the diaphragm. Check sequence and position of parts to be sure reassembly is correct. 2. Consult your distributor for replacement.
PUMP MOTOR STALLS	1. Pumping against excessive pressure 2. Low voltage to pump	1. Test pressure to determine if it exceeds pump specifications. If so, consult your distributor. 2. Make sure voltage of power source matches the voltage on the pump specifications label. If not transformers are available.
MOTOR RUNNING VERY HOT	1. Low voltage. 2. If using a step-down transformer, it may be undersized for the pump	1. Power supply voltage should match voltage on pump specification label. 2. Check the transformer to be sure it has at least 100 watts capacity.

SERIES 100/150 DRIVE ASSEMBLY

ITEM	PART #	DESCRIPTION	QTY
* 1	J30496	HOUSING, S100 3,7,15,30-gpd	1
	J30497	HOUSING, S100 24-gpd	
	J30498	HOUSING, S150 68, 100-gpd	
2	25180	COVER, MOTOR	1
	J25212	COVER, MOTOR CE(EURO)	
3	34405	PLATE, COVER MOTOR	1
4	J34449	PLATE, BOTTOM HOUSING	1
5	25396	LABEL, DIAL	1
6	33760	PIN, STOP	1
7	31081	LEVER, LOCK S100	1
	31083	LEVER, LOCK S150	
8	37088	SCREW, OP ADJUST S150	1
	37089	SCREW, OP ADJUST S100	
9	30460	KNOB, OUTPUT ADJUST	1
ITEM	PART #	DESCRIPTION	QTY
10	32520/32524/32528	MOTOR, 7-rpm 115v/230v/60hz & 230/50hz	1
	32521/32525/32529	MOTOR, 13-rpm 115v/230v/60hz & 230/50hz	
	32522/32526/32530	MOTOR, 25-rpm 115v/230v/60hz & 230/50hz	
	32523/32527/32531	MOTOR, 51-rpm 115v/230v/60hz & 230/50hz	



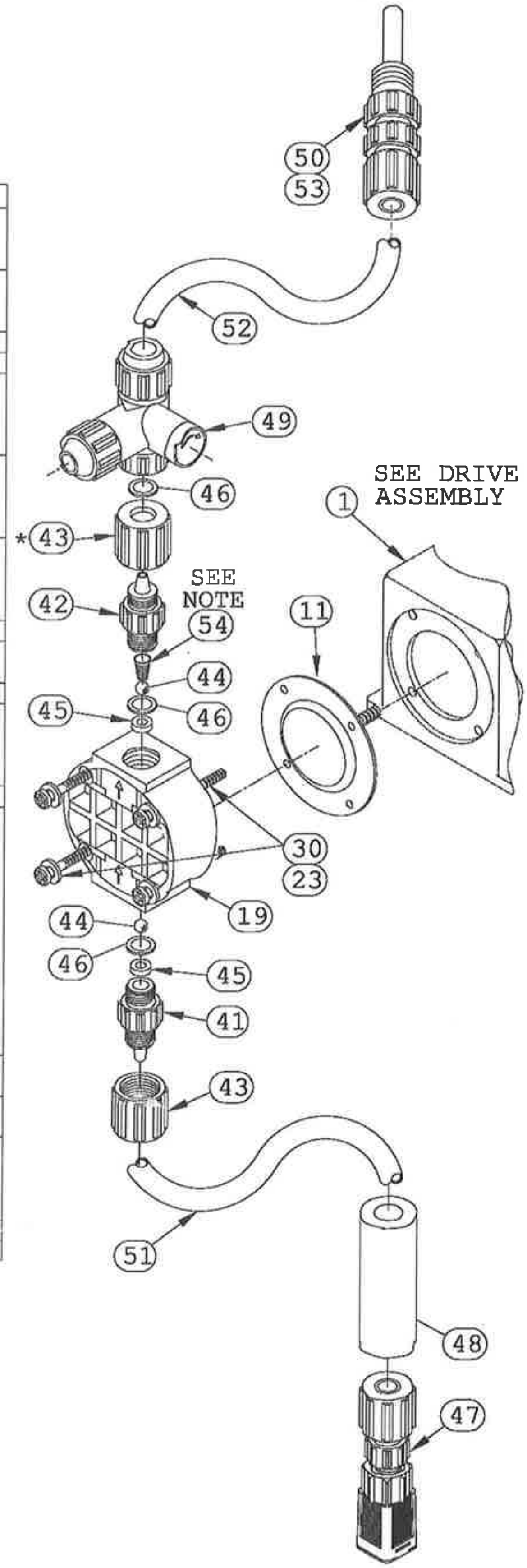
ITEM	PART #	DESCRIPTION	QTY
*12	J34379	BACKING PLATE AS'Y	1
13	38980	SPRING, DIAPHRAGM RETURN	1
14	21829	BRACKET AS'Y, DRIVE	1
15	22255	CAM/BEARING AS'Y,S100 3,7,15,30-gpd	1
	22256	CAM/BEARING AS'Y, S100 24-gpd	
	22257	CAM/BEARING AS'Y, S150 68, 100-gpd	
*18	20850	BEARING, NEEDLE	1
20	24820	CORD, 6ft. 115vAC	1
	24821	CORD, 6ft. 230vAC	
	J24829	CORD, 6ft. 230vAC/CE(EURO)	
22	L9900700-000	CONNECTOR, STRAIN RELIEF	1
24	37031	SCREW, #8-AB x .38in.-lg. H.W.HD	1
25	37032	SCREW, #8-B x .44in.-lg. H.W.HD	2
26	J37033	SCREW, #8-B x .50in.-lg. H.W.HD	3
27	37047	SCREW, SET 10-32 x .25in.-lg.	2
28	37049	SCREW, SET 10-32 x .75in.-lg.	3
29	42041	WASHER(STL), .26in.-I.D.	1
30	J42020	WASHER(STL), #10	3
31	42045	WASHER(STL), #8 EXT. RH LOCK	1
32	L9800600-STL	NUT, #10-32 HEX	3

* = ITEMS INCLUDED IN HOUSING ITEM #1.

SERIES 100/150 WETEND ASSEMBLY

ITEM	PART #	DESCRIPTION	QTY
11	25704	DIAPHRAGM(HYP) AS'Y	1
	25706	DIAPHRAGM(VIT) AS'Y	
	25707	DIAPHRAGM(TFE) AS'Y	
19	28800	HEAD(SAN-ACRYLIC), PUMP	1
	J28801	HEAD(PVC), PUMP	
	28803	HEAD(FPP), PUMP	
23	J37005	SCREW(SST), #10-24 x 2in.-lg. PHP	4
30	J42020	WASHER(STL), #10-FLAT	4
41	J41548	BODY(PVC), SUCTION VALVE Ø.5in.-TUBE	1
	41549	BODY(FPP), SUCTION VALVE Ø.5in.-TUBE	
	41551	BODY(PVC), SUCTION VALVE Ø.38in.-TUBE	
	41552	BODY(FPP), SUCTION VALVE Ø.38in.-TUBE	
42	J41540	BODY(PVC), DISCHARGE VALVE Ø.5in.-TUBE	1
	41541	BODY(FPP), DISCHARGE VALVE Ø.5in.-TUBE	
	41543	BODY(PVC), DISCHARGE VALVE Ø.38in.-TUBE	
	41544	BODY(FPP), DISCHARGE VALVE Ø.38in.-TUBE	
43*	J24960	NUT(PVC), COUPLING Ø.50in.-TUBE STD.	2
	24961	NUT(FPP), COUPLING Ø.50in.-TUBE	
	24963	NUT(PVC), COUPLING Ø.38in.-TUBE	
	24964	NUT(FPP), COUPLING Ø.38in.-TUBE	
44	J20560	BALL(CER), Inq command	
45	J37440	SEAT(HYP), VALVE	2
	J37442	SEAT(VIT), VALVE	
46	J27903	GASKET(TFE)	2-3
47	J60717	STRAINER AS'Y/FOOT VALVE(PVDF/HYP/C/Ø.38	1
	J60718	STRAINER AS'Y/FOOT VALVE(PVDF/VTN/C/Ø.38	
	J60729	STRAINER AS'Y/FOOT VALVE(PVDF/HYP/C/Ø.50	
	J60730	STRAINER AS'Y/FOOT VALVE(PVDF/VTN/C/Ø.50	
48	L9906700-000	WEIGHT(CER), STRAINER	1
49	J30507	KIT, BLEED VALVE PVC/HYP/Ø.38in.-TUBE	1
	J30509	KIT, BLEED VALVE PVC/VTN/ "	
	J30510	KIT, BLEED VALVE PVC/TFE/ "	
	J30511	KIT, BLEED VALVE FPP/HYP/ "	
	J30513	KIT, BLEED VALVE FPP/VTN/ "	
	J30514	KIT, BLEED VALVE FPP/TFE/ "	
	J30515	KIT, BLEED VALVE PVC/HYP/Ø.50in.-TUBE	
	J30517	KIT, BLEED VALVE PVC/VTN/ "	
	J30518	KIT, BLEED VALVE PVC/TFE/ "	
	J30519	KIT, BLEED VALVE FPP/HYP/ "	
	J30521	KIT, BLEED VALVE FPP/VTN/ "	
	J30522	KIT, BLEED VALVE FPP/TFE/ "	
50	41693	INJECTION FITTING PVC/HYP/C Ø.38in.-T	1
	J41694	INJECTION FITTING PVC/HYP/C Ø.50in.-T	
51	00006	SUCTION TUBING(PVC) Ø.44in.-O.D.	4-ft.
	00007	SUCTION TUBING(PVC) Ø.38in.-O.D.	
52	00008	DISCHARGE TUBING(PE-WHT) Ø.50in.-O.D.	8-ft.
	00009	DISCHARGE TUBING(PE-BLK) Ø.50in.-O.D.	
	00010	DISCHARGE TUBING(PE-WHT) Ø.38in.-O.D.	
	00011	DISCHARGE TUBING(PE-BLK) Ø.38in.-O.D.	
53	J39010	SPRING, INJECTION BACKCHECK(not shown)	1
54	J38985	SPRING(HCO),HEAVY S100/2/3/INJ(SEE NOTE)	1

* NOT USED WITH BLEED VALVE.
(NOTE: X003 AND X007 ONLY)



BALDOR

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Part Information Packet

BALDOR HAYWARD

09R044X763G1

20HP,3520RPM,3PH,60HZ,256TC,0940M,TEFC,F

Part Detail

Revision:	M	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0940M	**Elec. Spec:**	09WGX763	**CD Diagram:**	
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	09R044	**Layout:**	
Frame:	256TC	**Mounting:**	F1	**Poles:**	02	**Created Date:**	
Base:	N	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	04-27-2009
Leads:	9#12	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1259L

CAT.NO.							
SPEC.	09R044X763G1						
HP	20						
VOLTS	230/460						
AMP	45/22.5						
RPM	3520						
FRAME	256TC	**HZ**	60	**PH**	3		
SER.F.	1.15	**CODE**	H	**DES**	B	**CL**	F
NEMA-NOM-EFF	92.4	**PF**	90				
RATING	40C AMB-CONT						
CC		**USABLE AT 208V**	49				
DE	6309	**ODE**	6208				
ENCL	TEFC	**SN**					

Parts List

Part Number	Description	Quantity
SA086051	SA 09R044X763G1	1.000 EA
RA079119	RA 09R044X763G1	1.000 EA
S/P107-000-005	SUPER-E PROC'S(254/6 FR.) ZK PLANT - POL	1.000 EA
HW1002A63	WASHER, 5/8 HI-COLLAR SPRLCKWASHER	1.000 EA
09CB3000SP	CONDUIT BOX CAST	1.000 EA
09GS1000SP	GASKET-CONDUIT BOX, 1/16 THICK LEXIDE	1.000 EA
10XN2520K12	1/4-20 X.75 GRD 5	2.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	2.000 EA
WD1000B17	LUGSDIRECT WIRE LUG, CAT # S6	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
09EP1100A14SP	ENDPLATE, MACH	1.000 EA
HW5100A08	W3118-035 WVY WSHR (WB)	1.000 EA
10XN2520K28	1/4-20 X 1.75" HX HD SCRWGRADE 5, ZINC P	2.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	2.000 EA
09EP1300A12	ENDPLATE, MACH	1.000 EA
10XN2520K36	1/4-20 X 2.25" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HA3113A02	THRUBOLT 3/8-16X16.625	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	8.000 EA
XY3816A12	3/8-16 FINISHED NUT	4.000 EA
09FH1000A03	SPL FAN HOUSING 309 FRAME	1.000 EA
HA2081A05	SPACER TUBE, 309 FAN HSG, 2.00 LONG	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
XY3816A12	3/8-16 FINISHED NUT	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
09FH1500A01	DRIP COVER, MACH 309 FRAME	1.000 EA
10XN2520K30	STD.25X20 THD HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1000A25	1/4 SAE FLAT WASHER (FS)	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
09CB3500SP	CONDUIT BOX LID, CAST	1.000 EA
09GS1001SP	GASKET-CONDUIT BOX LID, 1/16 THICK LEXID	1.000 EA
51XW2520A12	.25-20 X .75, TAPTITE II, HEX WSHR SLTD	2.000 EA
HW4600B44SP	V-RING SLINGER 1.500 X 2.290 X 0.280	1.000 EA
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
PK6014	STEEL STRAP FOR 309-310 BASELESS MOTORS	3.000 EA
10XN3118K12	5/16-18 X .75 GRADE 5, ZINC PLATED	3.000 EA
HW4500A05	1669B ALEM/UNIV860 GR FTG X	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON	0.080 LB
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
37FN3002C02	EXFN, PLASTIC, 6.00 OD, 1.500 ID	1.000 EA
HW2500A25	WOODRUFF KEY USA #1008 #BLOW CARBON STEE	1.000 EA
51XB1214A20	12-14X1.25 HXWSSLD SERTYB	1.000 EA
HW4500A03	GREASE FITTING, .125 NPT 1610(ALEMITE) 8	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA

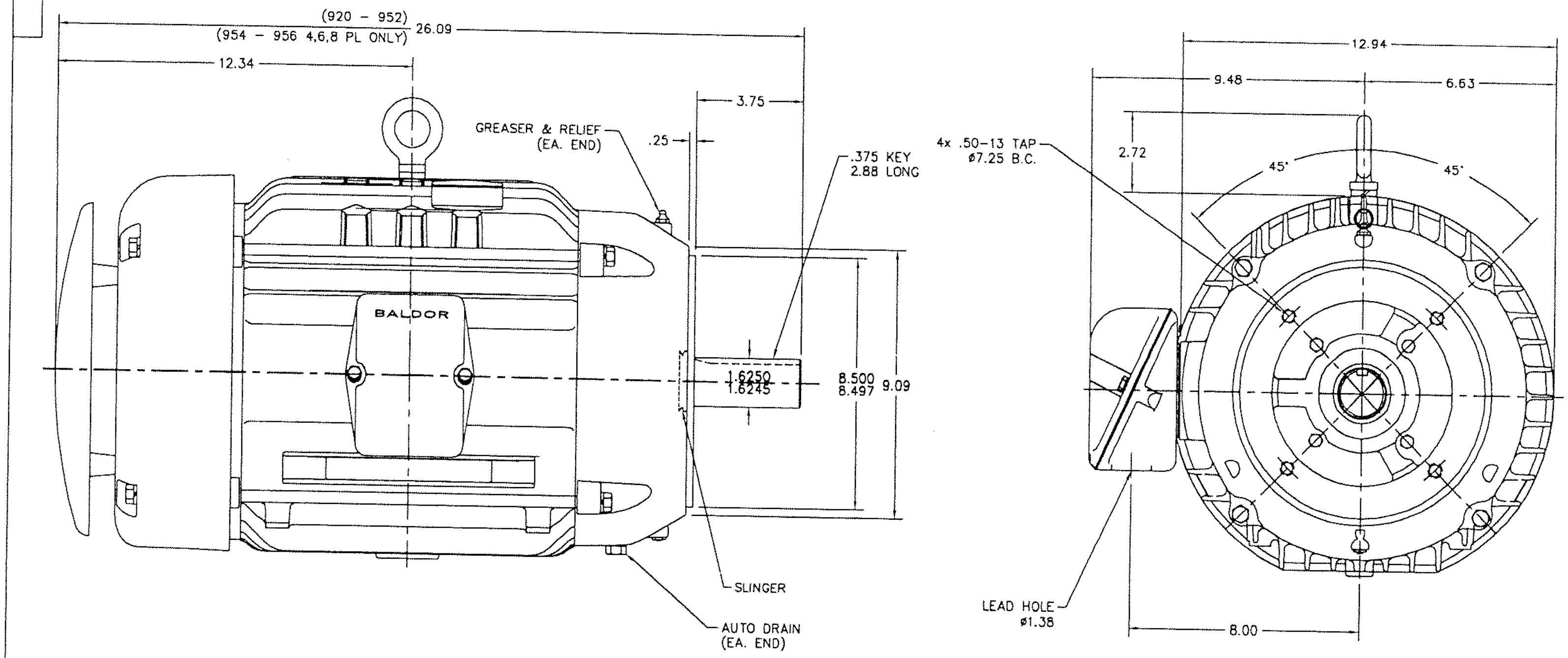
Parts List (continued)

Part Number	Description	Quantity
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY	0.050 GA
85XU0407A04	#4-7 X 1/4 DRIVE PIN	2.000 EA
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	4.000 EA
LC0005E02	SPL CONN.DIA./WARN.LABEL(LC0005/LB1119)	1.000 EA
NP1259L	SUPER E, ALUM, UL CSA CC, W/O THERMAL,	1.000 EA
40PA1005	PACKAGING GROUP, 09 STD	1.000 EA

Performance Data at 460V, 60Hz, 20.0HP (Typical performance - Not guaranteed values)			
General Characteristics			
Full Load Torque:	29.8 LB-FT	Start Configuration:	DOL
No-Load Current:	6.79 Amps	Break-Down Torque:	132.0 LB-FT
Line-line Res. @ 25°C.:	0.411 Ohms A Ph / 0.0 Ohms B Ph	Pull-Up Torque:	33.2 LB-FT
Temp. Rise @ Rated Load:	73 C	Locked-Rotor Torque:	50.8 LB-FT
Temp. Rise @ S.F. Load:	98 C	Starting Current:	165.7 Amps

Load Characteristics

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor:	59.0	79.0	86.0	90.0	91.0	91.0	90.0
Efficiency:	89.0	92.5	93.0	92.5	91.7	90.5	92.1
Speed:	3582.0	3563.0	3543.0	3523.0	3501.0	3476.0	3510.0
Line Amperes:	8.95	12.78	17.5	22.59	28.14	34.22	25.89

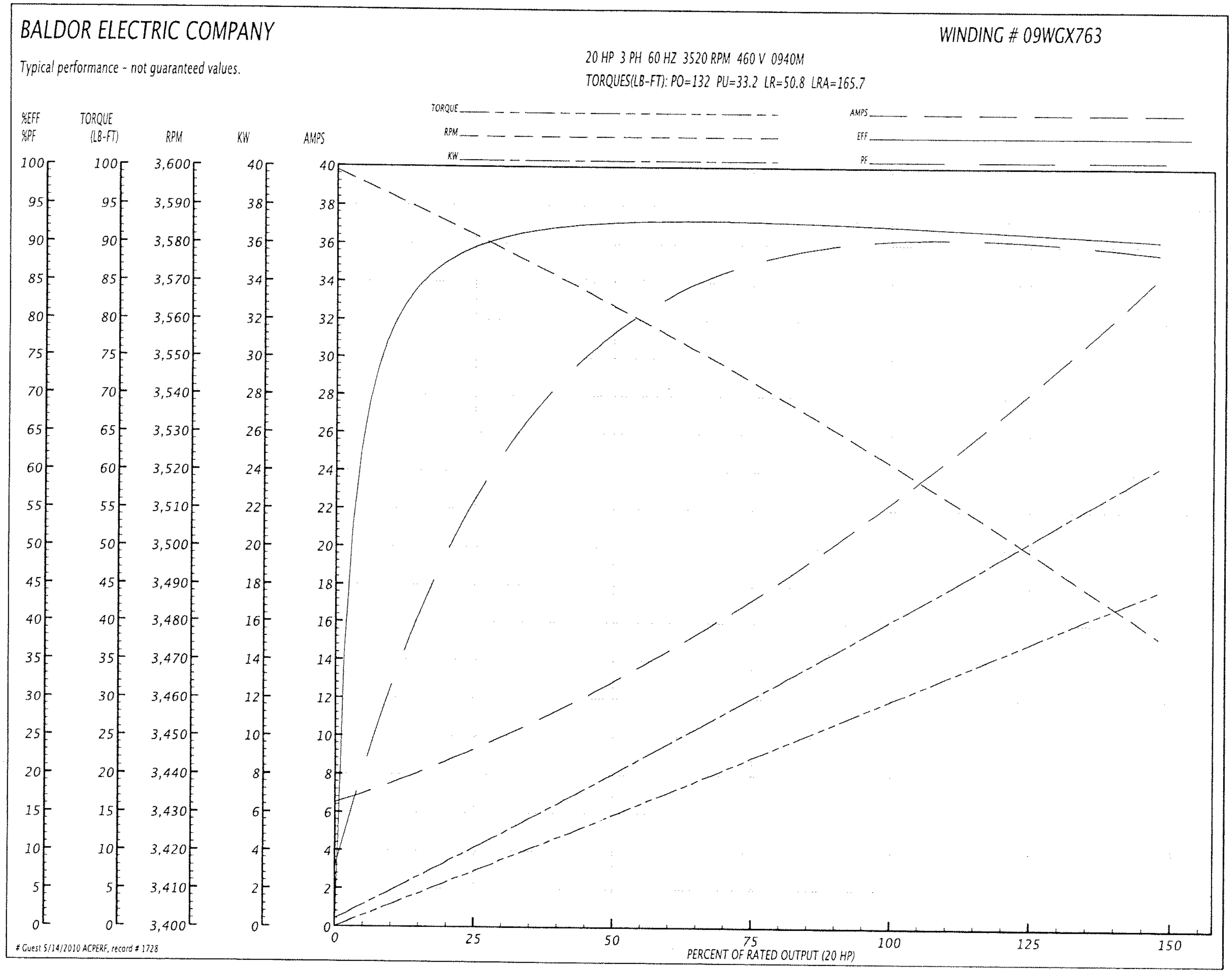


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

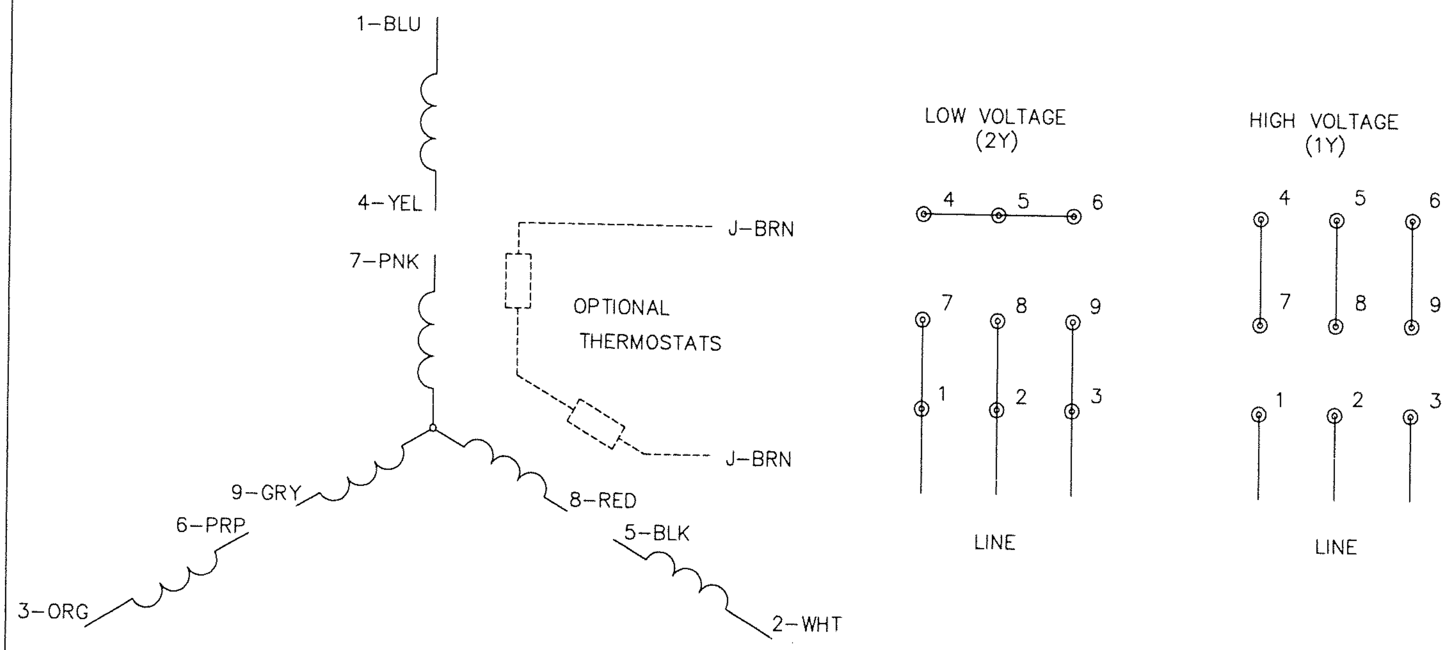
REV. DESC: REPLACE HA2081A01 WITH HA2081A05			Baldor • Dodge • Reliance
REV. LTR: E	VERSION: 03	TDR: 000000463373	
FILE: \AAA\00038\769	REVISED: 08:28:02 04/28/2008	BY: ENCARCO	VERT TEFC 254-6TC W/DRIP COVER
MTL: -			

09LYR044

Performance Graph at 460V, 60Hz, 20.0HP Typical performance - Not guaranteed values



CD0005



NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS				BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435	
CD0005		FILE: AAA00005140	MDL: –	3PH, DV, 9 LEADS
		MTL: –		

CD0005

BALDOR
A MEMBER OF THE ABB GROUP

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Product Information Packet

VL3506

.75HP,3450RPM,1PH,60HZ,56C,3424L,TEFC,F1

Part Detail

Revision:	T	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	3424L	Elec. Spec:	34WG3405	CD Diagram:	
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	34K043	Layout:	
Frame:	56C	Mounting:	F1	Poles:	02	Created Date:	
Base:	N	Rotation:	R	Insulation:	B	Eff. Date:	06-17-2011
Leads:	6#18	Literature:		Elec. Diagram:		Replaced By:	

Nameplate NP1256L

CAT.NO.	VL3506						
SPEC.	34K43-3405						
HP	.75						
VOLTS	115/230						
AMP	9.6/4.8						
RPM	3450						
FRAME	56C	HZ	60	PH	1		
SER.F.	1.25	CODE	K	DES	N	CLASS	B
NEMA-NOM-EFF	66	PF	74				
RATING	40C AMB-CONT						
CC		USABLE AT 208V	6.1				
DE	6203	ODE	6203				
ENCL	TEFC	SN					
	SFA 11.6/5.8						

Parts List

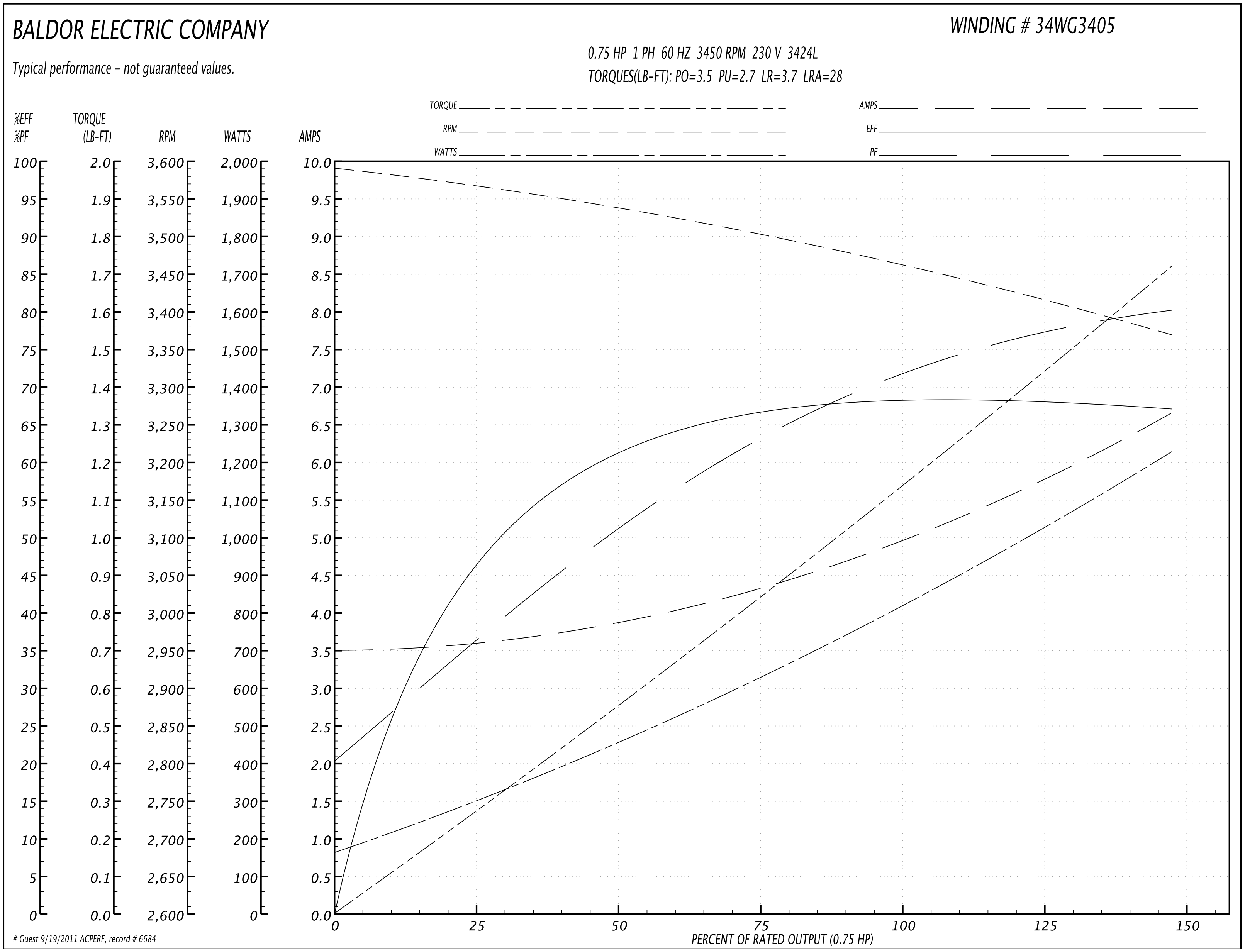
Part Number	Description	Quantity
SA008171	SA 34K43-3405	1.000 EA
RA004618	RA 34K43-3405	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
34CB3002A	CB CAST W/.88 DIA HOLE	1.000 EA
34GS1029A01	GASKET, CONDUIT BOX	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
34EP3102A01SP	FR ENDPLATE, MACH	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	2.000 EA
NS2501A01	INSULATOR, CAPACITOR	1.000 EA
51XB1016A05	10-16X5/16HX WA SL SR TYB (F/S)	2.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
34EP3300A24SP	PU ENDPLATE, MACH	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
34FN3002A01SP	EXTERNAL FAN, PLASTIC, .637/.639 HUB W/	1.000 EA
34FH4002A01SP	IEC FH NO GREASER	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
34CB4517	CB LID 4 MTG HOLES .22 DIA STAMPED, FOR	1.000 EA
34GS1031A01	GASKET, FLAT CONDUIT BOX LID (LEXIDE)	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A04	KEY RETAINER 0.625 DIA SHAFTS	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY 55 GALLONS	0.014 GA
10XF0440S02	04-40 X 1/8 TYPE F HEX HD STAINLESS STIC	2.000 EA

Parts List (continued)

Part Number	Description	Quantity
EC1400A03SP	ELEC CAP, 400-480 MFD, 125V, 1.81D X 3.	1.000 EA
33CB4800A02	CAPACITOR COVER, STAMPED	1.000 EA
35GS3001A02	GASKET, CA.COVER, 5.38 LONG .06 CS301	1.000 EA
SP5056A24	MODEL 34 TYPE L STATIONARY SWITCH WITH L	1.000 EA
HA3100A44	THRUBOLT 10-32 X 8.000	4.000 EA
LB1125C01	STD (STOCK) CARTON LABEL BALDOR WITH FLA	1.000 EA
LC0001A01	CONN LABEL / WARNING LABEL (LC0001 / LB1	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
NP1256L	ALUM, UL CSA CC, W/O THERMAL, LASER	1.000 EA
34PA1005	PACKING GROUP, BALDOR	1.000 EA
PK3083T	STYROFOAM PACKING CRADLE W/TAPE	1.000 EA

Performance Data at 230V, 60Hz, 0.75HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:		1.15 LB-FT		Start Configuration:		DOL	
No-Load Current:		3.5 Amps		Break-Down Torque:		3.5 LB-FT	
Line-line Res. @ 25°C.:		2.5 Ohms A Ph / 2.5 Ohms B Ph		Pull-Up Torque:		2.7 LB-FT	
Temp. Rise @ Rated Load:		78 C		Locked-Rotor Torque:		3.7 LB-FT	
Temp. Rise @ S.F. Load:		92 C		Starting Current:		28.0 Amps	
Load Characteristics							
% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor:	36.0	51.0	62.0	70.0	76.0	81.0	0.0
Efficiency:	47.2	61.1	66.5	68.7	68.7	66.7	0.0
Speed:	3561.0	3534.0	3500.0	3464.0	3421.0	3365.0	0.0
Line Amperes:	3.6	3.9	4.4	5.0	5.7	6.7	5.7

Performance Graph at 230V, 60Hz, 0.75HP Typical performance - Not guaranteed values



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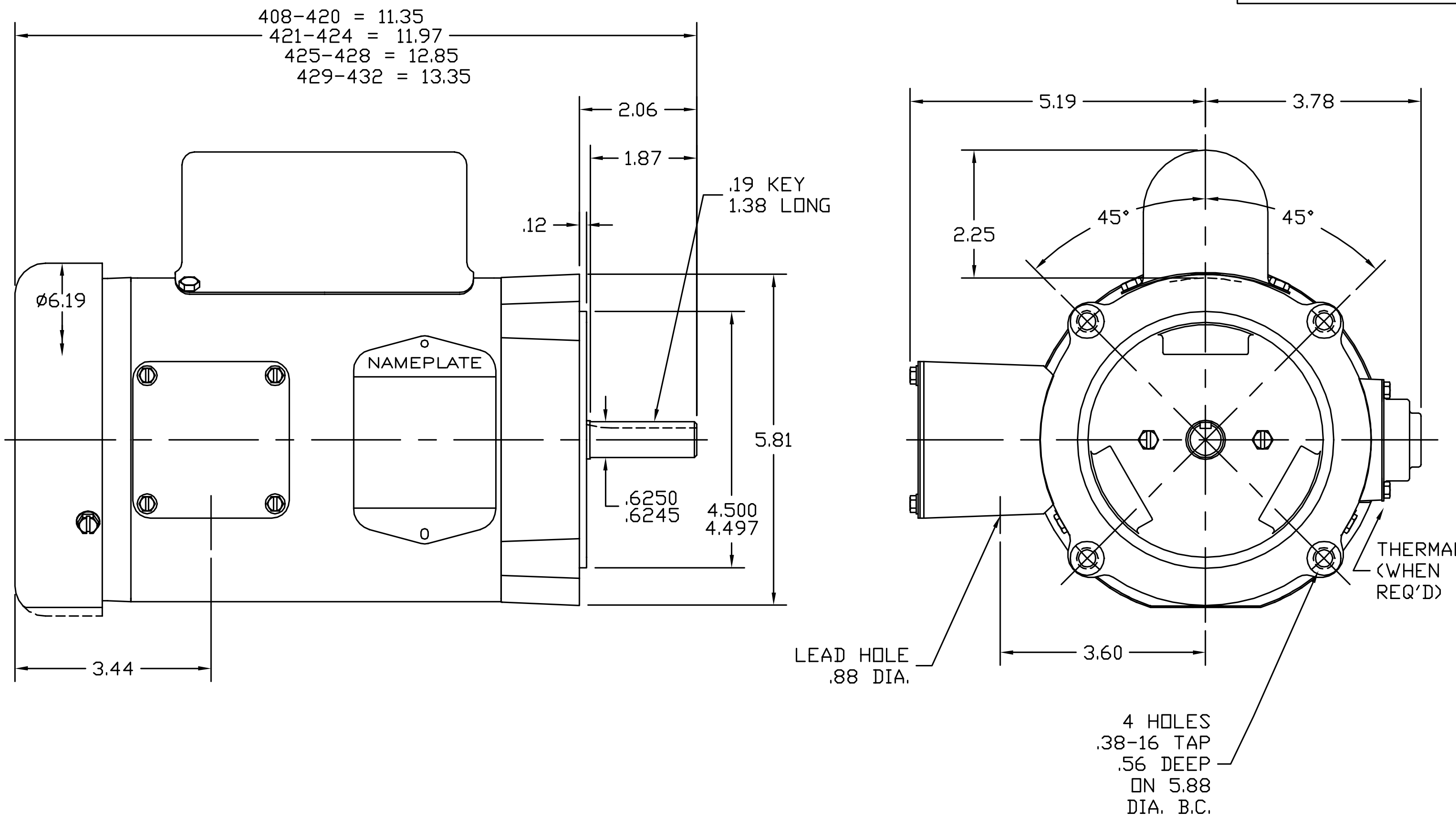
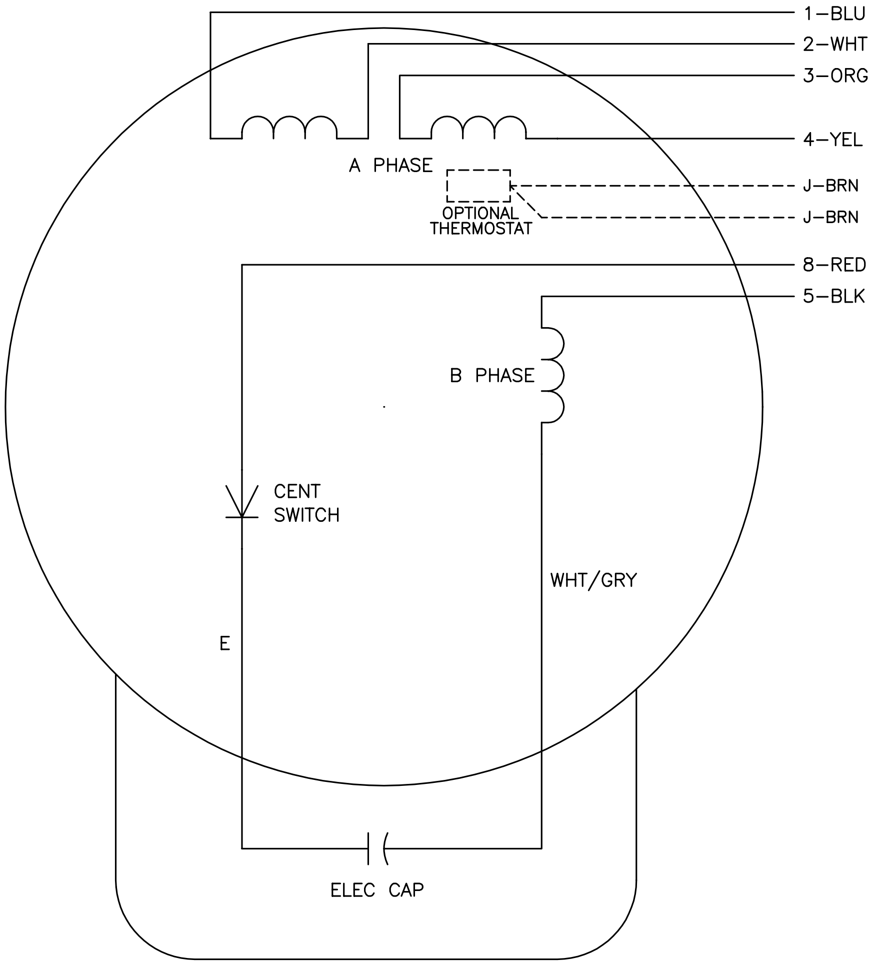


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

REV. DESC: UPDATED KOBX TO 34CB3002A PER BOM			BALDOR ELECTRIC Co.
REV. LTR: D	VERSION: 01	TDR: 000000397764	
34LYK043	FILE: \AAA\00025\911	REVISED: 15:10:02 05/25/2006	STD VERT 34L NEMA 56C TEFC W/35 CAPACITOR BOX
	MTL: –	BY: ENYOAD0	

34LYK043

CD0001



	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	–
LOW OPP	1,3,5	2,4,8	–

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0001

REV. DESC: REVISE TO SHOW OPTIONAL COLORS

REV. LTR: D | BY: JLP | REVISED: 04/08/99 1:16 | TDR: 0178636

CD0001 | FILE: AAA00007405 | MDL: –

MTL: –

BALDOR ELECTRIC Co.

TYPE L, DV, REV, 6 LEADS

SDL Project -Tank Sizes						
Clean in Place Tanks and Totes (Provided by New Logic)						
		Capacity	Influent	Capacity	Influent	Fill/Empty
		Metric	Rate	US	Rate	Time
Tank #	Name of Tank	Cubic Meter	m3/hr	Gallons	GPM	Minutes
T-190	Stage 1 CIP Tank	1.0	13.6	264	60.0	4
Process Tanks (Provided by others)						
		Capacity	Influent	Capacity	Influent	Fill/Empty
		Metric	Rate	US	Rate	Time
Tank #	Name of Tank	Cubic Meter	m3/hr	Gallons	GPM	Hours
T-100	VSEP EQ Tank	TBD	TBD	TBD	TBD	TBD
T-110	VSEP Batch Feed Tank	TBD	TBD	TBD	TBD	TBD
T-120	Concentrate Tank	TBD	TBD	TBD	TBD	TBD
T-130	Hot Water Tank	TBD	TBD	TBD	TBD	TBD
T-200	VSEP Permeate Tank T-200	TBD	TBD	TBD	TBD	TBD
T-210	VSEP Permeate Tank T-210	TBD	TBD	TBD	TBD	TBD
T-300	Spiral RO Permeate Tank	TBD	TBD	TBD	TBD	TBD
T-560	50% NaOH Drum	0.2	0.7	55	3.000	18
T-404	VSEP NLR 404 Storage Tote	1.0	0.001	264	0.003	53
T-505	VSEP NLR 505 Storage Tote	1.0	0.001	264	0.003	53

SDL Project -Tank Specifications

Clean in Place Tanks and Totes (Provided by New Logic)

Tank #	Name of Tank	Preferred Material	Alternate Materials	Jacket	Heat Transfer	Mixing	Pressure	Temp	Instruments
T-190	Stage 1 CIP Tank	Polypropylene	XLPE	None	None	No	Atmospheric	50-60ºC	Level

Process Tanks (Provided by others)

Tank #	Name of Tank	Preferred Material	Alternate Materials	Jacket	Heat Transfer	Mixing	Pressure	Temp	Instruments
T-100	VSEP EQ Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-110	VSEP Batch Feed Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-120	Concentrate Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-130	Hot Water Tank	304L ss	Polypropylene	Yes	Yes	No	Atmospheric	50-60ºC	Level, Temp
T-200	VSEP Permeate Tank T-200	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-210	VSEP Permeate Tank T-210	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-300	Spiral RO Permeate Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-560	50% NaOH Drum	HDPE	Polypropylene	Yes	None	No	Atmospheric	Ambient	None
T-404	VSEP NLR 404 Storage Tote	HDPE	Polypropylene	None	None	No	Atmospheric	Ambient	None
T-505	VSEP NLR 505 Storage Tote	HDPE	Polypropylene	None	None	No	Atmospheric	Ambient	None

Chem-Tainer Tank Information

Material Selection

Chemtainer.com offers you a selection of materials that are by far the best suited for molded tanks and containers for use with aggressive corrosive chemicals as well as food products. Our 35 plus years of experience in rotational molding, combined with our professional staff of chemical, mechanical and plastics engineers, enables us to provide you with the highest quality rotationally molded tanks and containers available in the industry.

The following is a brief description of these materials:

Polyethylene

A high quality thermoplastic that has outstanding resistance to both physical and chemical attack. The overall general toughness and excellent chemical resistance to a wide array of wet and dry industrial chemicals and food products make polyethylene ideally suited for storage tanks and containers.

Polyethylene is translucent and its natural color ranges from slightly off white to creamy yellow, depending on wall thickness and type. Ultraviolet light stabilizers are added for use in outdoor applications. Colors are available on request for a nominal up charge.

A) Linear Polyethylene

Linear Polyethylene is available as low, medium and high density. Most products offered in this catalog are molded of linear medium density polyethylene (LMDPE) and linear high density polyethylene (LHDPE). They have superior mechanical properties, high stiffness, excellent low temperature impact strength and excellent environmental stress crack resistance. The linear polyethylene used by Chem-Tainer meets specifications contained in FDA regulation 21CFR177.1520 (c) 3.1 and 3.2 and so may be used as an article or a component of articles intended for use in contact with food, subject to any limitations in the regulations. Maximum operating temperature for linear polyethylene is 140° F.

B) Crosslinkable Polyethylene

Crosslinkable polyethylene is a high density polyethylene that contains a crosslinking agent which reacts with the polyethylene during molding, forming a crosslinked molecule similar to a thermoses plastic. This reaction improves toughness and environmental stress crack resistance. Crosslinked Polyethylene (XLPE) is not weldable and does not meet FDA requirement 21CFR177.1520. Maximum operating temperature of crosslinked polyethylene is 150° F.

2) Polypropylene

Polypropylene is a rigid plastic that has a higher operating temperature limit than polyethylene: 212° F. It offers good chemical resistance, has a high resistance to stress crack, and is autoclavable. Polypropylene (PP) is not recommended for applications in sub-freezing temperature or where high impact strength is needed. A rough, irregular interior surface is common characteristic of molded polypropylene.

Considerations to Material Selection

Elevated Temperatures

Continued or prolonged service with contents at elevated temperatures can shorten the life of a tank. The effects of the temperature will depend on the chemical content and its specific gravity, tank size and configuration, material of construction, wall thickness and if there are any external supports on the tank.

Exposure to Ultraviolet Light

Unprotected thermoplastics exposed to sunlight for an extended period of time, absorb ultraviolet (UV) light, which can cause discolorations, embrittlement and eventual cracking. Fluorescent lighting has a similar effect. Elevated temperatures can accelerate the embrittling process. Chem-Tainer products are molded from materials utilizing the latest technology for UV stabilizers which greatly reduce the harmful effects of UV light. For greater protection, keep tanks out of direct sunlight or order dark colored tanks which will further retard the effect of UV light.

Environmental Stress Cracking

Certain surface active materials, although they have no chemical effect on polyethylene, can accelerate its cracking when under stress, such as liquid detergents and ultra pure water- (see our chemical compatibility Chart on pages 46 - 49.) Elevated temperatures tend to accelerate the cracking. Although all polyethylenes are subject to stress cracking, some are more resistant to it than others. The degree of stress on the plastic has a direct bearing on its resistance, therefore a tank and system should be designed to minimize stress. Chemtainer.com tanks are molded visually stress free, employing materials that are highly resistant to environmental stress cracking, and hence are less prone to cracking than fabricated tanks. Stress cracking agents are surface active materials. Proper care should be taken to reduce stress at fillings, bands, tie down lugs, etc.

Characteristics and Physical Properties

General Characteristics	Linear	XLPE	PP
Maximum Service Temp	140 F (60 C)	150 F (65 C)	212 F (100 C)
Chemical Resistance	Very Good	Very Good	Very Good
Stress Crack Resistance	Excellent	Excellent	Excellent
General Toughness	Very Good	Very Good	Fair
Impact Resistance	Excellent	Excellent	Poor
Abrasion Resistance	Good	Good	Good
Rigidity	Good	Good	Good
Color	WH Translucent	Off WH Trans	Off WH Opaque
FDA Compliance	Yes	No	Yes
Outdoor Use	Yes	No	Yes
Weildable	Yes	No	Yes
Recyclable	Yes	No	Yes
Physical Properties (Nominal Values)	**Linear**	**XLPE**	**PP**
Density (gm/cc) ASTM:D1505	0.937-0.942	0.937-0.942	0.901-0.905
Environmental Stress Cracking (F-50hrs) ASTIM:D1693	>1,000	>1,000	>1,000
Tensile Strength ASTIM:D638 Ultimate 2"/Min (PSI) Type IV	2,600	2,600	3,000
Elongation at Break ASTIM:D638 2"/Min(%) Type IV	450	450	5
Flexural Modulus (PSI) ASTIM:D790	100,000-110,000	100,000-110,000	90,000-100,000
Brittleness Temp ASTIM:D746	<-94F (-70 C)	-180 F (-118 C)	32 F (0 C)
VICAT Softening Temp ASTIM:D152B	240F	240F	300F

Tank Handling, Installation & Use Guidelines

Although Chemtainer's tanks are extremely durable, improper handling and installation can result in damage to tank, fittings, and accessories. Failure to comply with handling and installation instructions voids all warranties.

1. At delivery, inspect your tank immediately for defects or shipping damage. Any discrepancies, or product problems, should be noted on both the driver's bill of lading and your packing list.

2. When unloading your tank from the delivery truck, avoid its contact with sharp objects. Forklift blades can cause significant damage if proper precautions are not taken. Do not allow tanks to be rolled over on the fittings. Large bulk storage tanks, whenever possible, should be removed from truck bed by use of a crane or other suitable lifting device. OSHA regulation 29CFR 1910.178 through 1910.189 addresses specific standards for hoisting and lifting. Keep unloading area free of rocks, sharp objects, and other materials that could damage the tank. If tank is unloaded on it's side, carefully brace to prevent rolling.

3. Support bottom of tank firmly and completely. Concrete pads provide the best foundation. However, when seismic and wind factors are not being considered, tanks with a base load bearing of less than 800 pounds per square foot require a firm, even, compacted bed of sand, pea gravel, or fine soil that won't wash away. Tanks with a base load bearing of 800 pounds per square foot, or greater, require a reinforced concrete base. Steel support stands concentrate the loaded tank weight onto the stand leg pads. It is recommended that stands are mounted on a concrete base. Bolting of stands is necessary to prevent movement due to agitation, wind, seismic loads and accidental contact.

4. Install tanks in an area that is accessible. Ease of maintenance and removal should be considered.

5. Test by filling tank with water prior to use, to prevent material loss through unsecured fittings, shipping damage, or manufacturing defects. Tanks should be tested for a minimum 5 hours.

6. Plastic screw on bulkhead fittings are designed to be hand tightened. Overtightening can cause fittings to leak.

7. Support sides of rectangular tanks. In general, tanks with heights greater than 18" must be supported. However, specific applications must be considered: smaller tanks with contents that have high specific gravity and/or elevated temperatures must be supported.

8. Do not mount heavy equipment on tank sides.

9. Do not allow weight on tank fittings. Fully support pipes and valves.

10. Use expansion joints to prevent damage at fittings from the differential expansion and contraction of the piping and tanks.

11. Tanks are designed for use only in the atmospheric storage of chemicals, never for vacuum or pressure applications.

12. Immersion heaters should never touch the walls of the tank. Minimum spacing should be 3" - 4" from wall.

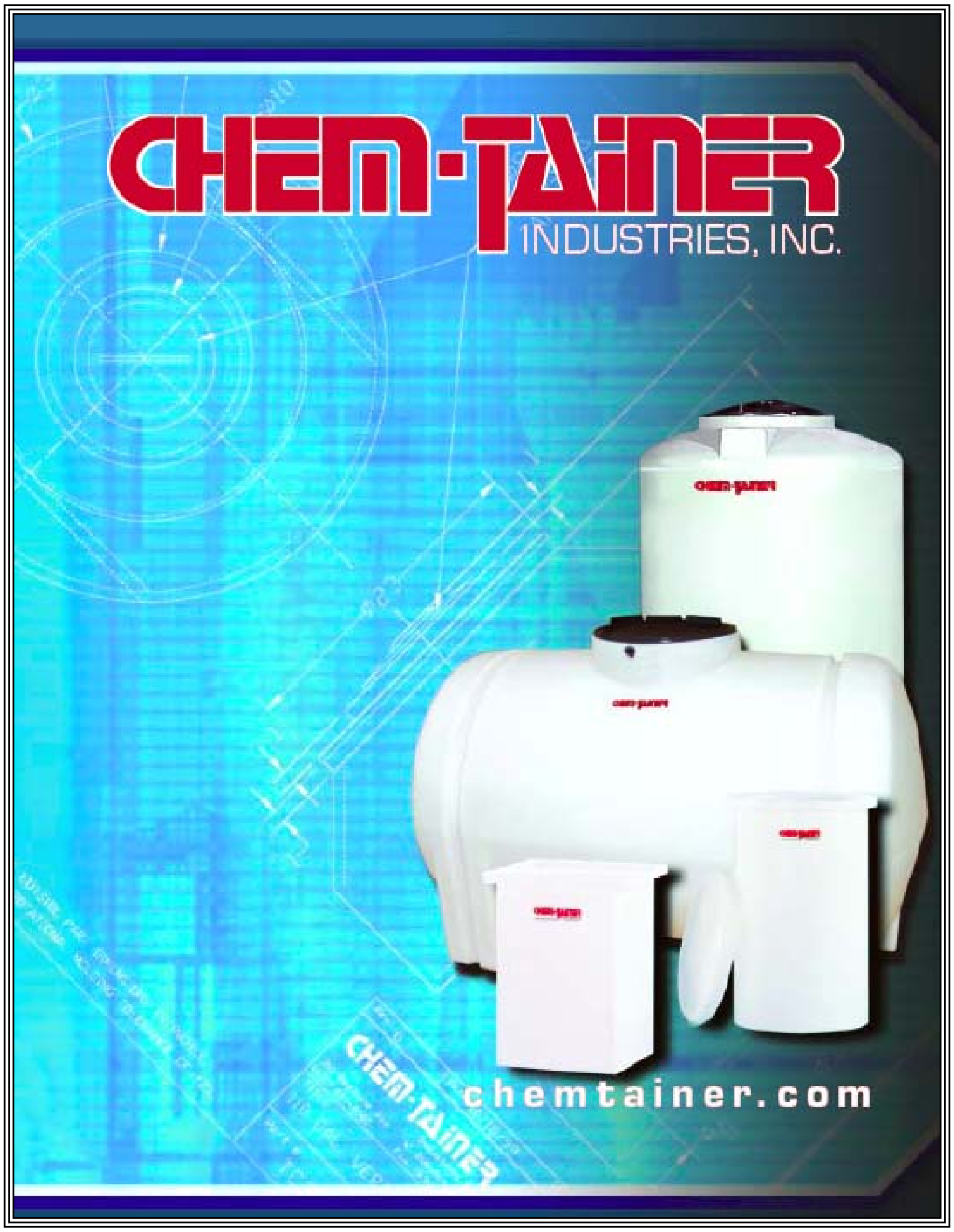
13. Refer to the chemical capability chart on this site as a guide. Be certain tank, fittings, and fitting gasket material are compatible with chemicals at the anticipated operating temperatures. Contact our technical staff for information on chemicals not listed, or when uncertain conditions exist.

14. Protect tanks from impact, especially at temperatures below 40 degrees F.

15. Confined spaces must be considered hazardous. Do not enter tank without first taking proper precautions.

16. Tank sizes as listed are nominal and calibrations on molded tanks are only approximates, but provide an indication of volume. Polyethylene tanks expand and contract which will effect volume. The degree in which this occurs depends on the size of the tanks, wall thickness, specific gravity of contents, temperature of contents and ambient temperatures.

Specifications Manual



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1.0 DESCRIPTION OF TANK

1.1 SPECIFICATIONS (see pages 4-7)

1.2 GENERAL

These are one piece tanks, rotationally molded of linear medium or high density polyethylene or high density crosslinkable polyethylene (XLPE). Refer to material type in the tank charts for availability. Tanks come in a variety of shapes, are available in closed head designs with flat bottom (IC, IA & IX series), conical bottom (JA & JC series), round horizontal (LC & LA series) or oval horizontal (MC & MA series).These tanks can be furnished with various accessories as per customer specifications and are capable of holding aggressive chemicals at atmospheric pressure. Open top mixing and processing tanks are available in cylindrical, conical bottom and rectangular designs, refer to Chem-Tainer product catalog.

2.0 MATERIALS

2.1 LINEAR POLYETHYLENE

A high quality, chemically resistant plastic with high stress crack and impact resistance. Linear polyethylene is translucent and exhibits properties that are ideal for applications that are exposed to low temperatures and/or high impact. Unlike thermosets, linear polyethylene is weldable, thus allowing for greater flexibility when designing modification to our standard tanks. The plastic complies with USDA and FDA regulations for storage and processing of food. Linear polyethylene is fully recyclable and thereby provides a convenient method of disposal.

2.2 CROSS-LINKED POLYETHYLENE

High density cross-linked polyethylene has excellent low temperature impact and environmental stress-crack resistance. This polyethylene is a thermoset, thus does not permit the utilization of welded tank connections. Cross-linked polyethylene does not have USDA or FDA compliance for storage of processing edibles and is not recyclable.

2.3 ULTRA VIOLET LIGHT STABILIZERS AND FILLERS

The plastic does contain a minimum of 0.25 to a maximum of 0.50 long term U.V. stabilizer. It does not contain any fillers.

2.4 PIGMENT

Pigment can be added at purchaser's request. These pigments would be compatible with the polyethylene and will not exceed 0.5% dry blended and 2% compounded in of the total weight.

3.0 TANK CONSTRUCTION

3.1 MECHANICAL PROPERTIES

The minimum for the properties of the material shall be as follows based on molded parts:

PROPERTY	ASTM	VALUE	UNITS
Density	D1505	59 (0.937 - 0.942)	#/ft^{3}(gm/cc)
ESCR Spec. Thickness			
125 Mils F-50	D1693	1000	Hrs.
Tensile Strength	D638		
Ultimate 2”/min.	Type IV Spec.	2600	PSI
Elongation at break	D638		
2”/min.	Type IV Spec.	450	%
Vicat Softening Temp.	D1525	240	Deg. F
Brittleness Temp.	D746	-180	Deg. F
Flexuarl Modulus	D790	100,000-110,000	PSI

3.2 APPEARANCE

The finished surface of the tank shall be free as commercially practicable from visual defect such as foreign inclusions, air bubbles, pin holes, craters, crazing and cracking that will impair the serviceability of the tank.

3.3 CUT EDGES

All edges cut out i.e., open top flanges, manways, shall be trimmed to have smooth edges.

3.4 DIMENSIONS AND TOLERANCES

General - all dimensions will be taken with the tank in its proper, usable position and unfilled. Tank dimensions will represent the exterior measurements.

3.4.1 Outside diameter – The tolerance for the outside diameter including out of roundness, shall be +/-3%.

3.4.2 3.4.2 Shell wall and head thickness - The tolerance for thickness shall be +/-20% of the design thickness. The total amount of an area on the low side of the tolerance shall not exceed 10% of the total area and individual area shall not exceed 1 ft. 2 (.09m2) in size.

3.5 PERFORMANCE REQUIREMENTS

The following performance requirements shall be conducted on samples taken from the manway cut out area or where fittings are inserted in each tank

3.5.1 Low Temperature Impact
Low temperature impact is determined by using a 30 lb. Falling dart at -20 degrees F.

Wall thickness in. (mm)	ft-lb. (J) to fail.
Less than & including 0.25 in. (6.6 mm)	90 (122.0)
0.26 in. (6.6 mm) to & including 0.50 in. (12.9 mm)	100 (135.5)
0.51 in. (12.9 mm) to & including 0.75 in. (19.3 mm)	150 (203.2)
0.76 in. (19.3 mm) to & including 1.00 in. (25.4 mm)	200 (271.0)

3.5.2 Percent Gel - for crosslinked polyethylene
The percent gel level is determined by using the test method found in ASTM D1998. The percent gel level for crosslinked tanks on the inside 0.125 in. (3.2mm) of the wall shall be a minimum of 60%.

3.5.3 Visual Inspection - The tank is visually inspected to determine such qualities as are discussed in Section 3.2, Appearance.

4.0 MARKINGS

4.1 The tank is marked to identify the producer - Chem-Tainer, Inc., date (month and year) of manufacture, capacity and serial number.

4.2 The proper caution and/or warning signs are affixed to the tank

4.3 Tank capacities should be based on total tank volume.

5.0 PACKAGING AND SHIPPING

5.1 All fittings and flange faces shall be protected from damage by covering with suitable plywood, hard-board or plastic securely fastened. Tanks shall be positively vented at all times.

5.2 Pipe and tubing, fittings and miscellaneous small parts shall be packaged. Loose items which may scratch the interior surface shall not be placed inside the tank during shipment. Additional protection, such as battens, end wrapping, cross bracing, or other interior fastenings may be required to assure each individual equipment pieces are not damaged in transit.

5.3 Upon arrival at the destination, the purchaser is advised to inspect for dam age in transit. If damage has occurred, a claim should be filled with the carier by the purchaser. The supplier should be notified if the damage is not first repaired by the fabricator prior to the product being put into service. The purchaser accepts all future responsibility for the effect of the tank failure resulting from damage.

5.4 It is recommended that the tank be hydrostacially tested at the time of installation.

ON PAGES 5-8 ARE LISTED
TANK DIMENSIONS
GALLONAGE
MATERIALS OF CONSTRUCTION
AND
SPECIFIC GRAVITY RATINGS
FOR ALL CHEM-TAINER BULK STORAGE TANKS.

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SPECIFICATIONS FOR POLYETHYLENE VERTICAL FLAT BOTTOM BULK STORAGE TANKS IC, IA AND IX SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
20	TA1628IC	16	28	8	Linear	1.5
25	TA1829IC	18	29	5	Linear	1.5
40	TA1841IC	18	41	5	Linear	1.5
45	TC1851IA	18	51	4	Linear	1.9
55	TC2038IA	20	38	8	Linear	1.9
65	TC2338IA	23	38	8	Linear	1.9
75	TC2349IA	23	49	8	Linear	1.9
100	TC2360IA	23	60	8	Linear	1.9
110	TC3536IC	35	36	8	Linear	1.5
110	TC3536IA	35	36	8	Linear	1.9
110	TC3635IX	35	36	8	XLPE	1.9
130	TC2376IC	23	76	8	Linear	1.5
130	TC2376IA	23	76	8	Linear	1.5
160	TA2866IC	28	66	8	Linear	1.5
165	TC3158IC	31	58	8	Linear	1.5
165	TC3158IA	31	58	8	Linear	1.9
210	TA4048IC	40	48	5	Linear	1.5
220	TC3563IC	35	63	8	Linear	1.5
220	TC3563IA	35	63	8	Linear	1.9
220	TC3563IX	35	63	8	XLPE	1.9
225	TA3172IC	31	72	8	Linear	1.5
300	TC3581IC	35	81	16	Linear	1.5
300	TC3581IA	35	81	16	Linear	1.9
300	TC3581IX	35	81	16	XLPE	1.9
300	TC4259IC	42	59	16	Linear	1.5
300	TC4259IA	42	59	16	Linear	1.9
300	TC4560IC	45	60	16	Linear	1.5
300	TC4560IA	45	60	16	Linear	1.9
300	TA4254IC	42	54	8	Linear	1.5
425	TA4275IC/IA	42	75	8	Linear	1.5 / 1.9
500	TA4676IC/IA	46	76	16	Linear	1.5 / 1.9
500	TC4676IC	46	76	16	Linear	1.5
500	TC4676IA	46	76	16	Linear	1.9
500	TC4676IX	46	76	16	XLPE	1.9
500	TC6442IC	64	42	16	Linear	1.5
500	TC6442IA	64	42	16	Linear	1.9
500	TC6442IX	64	42	16	XLPE	1.9
550	TC4594IC	52	66	16	Linear	1.5
550	TC4594IA	45	94	16	Linear	1.5
550	TN6742IC	45	94	16	Linear	1.9
550	TA5266IC/IA	67	42	16	Linear	1.5 / 1.9
650	TC5660IC	56	60	16	Linear	1.5
650	TC5660IA	56	60	16	Linear	1.9
700	TC6460IC	64	60	16	Linear	1.5
700	TC6460IA	64	60	16	Linear	1.9
750	TC750XIC	46	119	16	Linear	1.5
750	TC750XIA	46	119	16	Linear	1.9

VERTICAL FLAT BOTTOM BULK STORAGE TANKS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
850	TC850XIC	48	124	16	Linear	1.5
850	TC850XIA	48	124	16	Linear	1.9
850	TC850XIX	48	124	16	XLPE	1.9
850	TA5492IC/IA	54	92	8	Linear	1.5/1.9
1000	TA6481IC/IA	64	81	16	Linear	1.5/1.9
1000	TN6481IC	64	81	16	Linear	1.5
1000	TN6481IA	64	81	16	Linear	1.9
1000	TC6481IX	64	81	16	XLPE	1.9
1000	TN6974IC	69	74	16	Linear	1.5
1000	TN6974IA	69	74	16	Linear	1.9
1100	TN8751IC	87	51	16	Linear	1.5
1100	TN8751IA	87	51	16	Linear	1.9
1200	TC8652IC	86	52	16	Linear	1.5
1200	TC8652IA	86	52	16	Linear	1.9
1200	TC8652IX	86	52	16	XLPE	1.9
1300	TN8758IC	87	58	16	Linear	1.5
1500	TA1500IC/IA	64	115	16	Linear	1.5/1.9
1500	TA8569IC/IA	85	69	16	Linear	1.5/1.9
1500	TC1500IC	64	121	16	Linear	1.5
1500	TC1500IA	64	121	16	Linear	1.9
1500	TC1500IX	64	121	16	XLPE	1.9
1550	TN8765IC	87	65	16	Linear	1.5
1550	TN8765IA	87	65	16	Linear	1.9
1650	TA8574IC/IA	85	74	16	Linear	1.5/1.9
1700	TC8674IC	86	74	16	Linear	1.5
1700	TC8674IA	86	74	16	Linear	1.9
1700	TC8674IX	86	74	16	XLPE	1.9
2000	TA2000IC/IA	64	156	16	Linear	1.5/1.9
2000	TA9083IC/IA	90	83	16	Linear	1.5/1.9
2000	TC2000IC	64	144	16	Linear	1.5
2000	TC2000IA	64	144	16	Linear	1.9
2000	TC2000IX	64	144	16	XLPE	1.9
2100	TN8787IC	87	87	16	Linear	1.5
2100	TN8787IA	87	87	16	Linear	1.9
2200	TC8696IC	86	96	16	Linear	1.5
2200	TC8696IA	86	98	16	Linear	1.9
2200	TC8696IX	86	96	16	XLPE	1.9
2500	TC9589IC	95	89	16	Linear	1.5
2500	TC9589IA	95	89	16	Linear	1.9
2500	TA2500IC/IA	90	100	16	Linear	1.5/1.9
2800	TC9598IC	95	98	16	Linear	1.5
2800	TC9598IA	95	98	16	Linear	1.9
2800	TC9598IX	95	98	16	XLPE	1.9
3000	TC3000IC	95	105	16	Linear	1.5
3000	TC3000IA	95	105	16	Linear	1.9
3000	TA3000IA	90	118	16	Linear	1.5
3200	TC3200IC	95	112	16	Linear	1.5
3200	TC3200IA	95	112	16	Linear	1.9
3200	TC3200IX	95	112	16	XLPE	1.9
3600	TC3600IC	86	156	16	Linear	1.5
3600	TC3600IA	86	156	16	Linear	1.9
3600	TC3600IX	86	156	16	XLPE	1.9
4000	TC4000IA	95	140	16	Linear	1.9
4000	TC4001IC	102	125	16	Linear	1.5
4000	TC4001IA	102	125	16	Linear	1.9
4000	TA4000IC/IA	96	140	16	Linear	1.5/1.9

VERTICAL FLAT BOTTOM BULK STORAGE TANKS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
4300	TC4300IC	120	105	16	Linear	1.5
4300	TC4300IA	120	105	16	Linear	1.9
4300	TC4300IX	120	105	16	XLPE	1.9
4500	TC4500IC	95	156	16	Linear	1.5
4500	TC4500IA	95	156	16	Linear	1.9
4500	TC4500IX	95	156	16	XLPE	1.9
5000	TC5000IC	102	151	16	Linear	1.5
5000	TC5000IA	102	151	16	Linear	1.9
5150	TA5150IC/IA	102	159	16	Linear	1.5/1.9
5600	TC5600IC	120	138	16	Linear	1.5
5600	TC5600IA	120	138	16	Linear	1.9
6250	TA6250IC/IA	102	194	16	Linear	1.5/1.9
6800	TC6800IC	120	150	16	Linear	1.5
6800	TC6800IA	120	150	16	Linear	1.9
6800	TC6800IX	120	150	16	XLPE	1.9
7800	TA7800IC/IA	120	178			
9000	TN9000IC	141	144	16	Linear	1.5
9000	TN9000IA	141	144	16	Linear	1.9
9150	TA9150IC/IA	120	206	16	Linear	1.5/1.9
10500	T10500IC	142	175	16	Linear	1.5/1.9
12000	T12000IC	141	192	16	Linear	1.5
12000	T12000IA	141	192	16	Linear	1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR POLYETHYLENE CONICAL BOTTOM
BULK STORAGE TANKS JC AND JA SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
200	TA4254JC/JA	42	54	Linear	1.5/1.9
300	TA4265JC/JA	42	65	Linear	1.5/1.9
345	TA5256JC/JA	52	56	Linear	1.5/1.9
350	TA4282JC/JA	42	82	Linear	1.5/1.9
500	TA5279JC/JA	52	79	Linear	1.5/1.9
1000	TA6498JC/JA	64	98	Linear	1.5/1.9
1500	TC8684JC	86	84	Linear	1.5
1500	TC8684JA	86	84	Linear	1.9
1600	TA9090JC	90	90	Linear	1.5
1700	TA8583JC/JA	85	83	Linear	1.5/1.9
2500	TA2500JC/JA	90	108	Linear	1.5/1.9
2600	TA2600JC/JA	90	126	Linear	1.5/1.9
2600	TA2600JC/JA	85	144	Linear	1.5/1.9
2650	TC2650JC	86	132	Linear	1.5
2650	TC2650JA	86	132	Linear	1.9
3000	TA3000JC/JA	90	125	Linear	1.5/1.9
4600	TA4600JC/JA	102	155	Linear	1.5/1.9
4900	TA4900JC/JA	102	159	Linear	1.5/1.9
5500	TN5500JC	119	146	Linear	1.5
5500	TN5500JA	119	146	Linear	1.9
7500	TN7500JC	141	148	Linear	1.5
7500	TN7500JA	141	148	Linear	1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR ELLIPTICAL HORIZONTAL BOTTOM
BULK STORAGE TANKS LC AND LA SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Diameter (inches)	Length (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
15	TA1430LC	14	30	5	Linear	1.5
25	TA1634LC	16	34	5	Linear	1.5
30	TC2218LA	22	18	4	Linear	1.9
35	TA1834LC/LA	18	34	5	Linear	1.5/1.9
65	TC2343LA	23	43	5	Linear	1.9
65	TA2439LC	24	39	5	Linear	1.5/1.9
125	TA3240LC	32	40	8	Linear	1.5/1.9
165	TA3251LC	32	51	8	Linear	1.5/1.9
200	TC3845LA	38	45	8	Linear	1.5
200	TC3845LA	38	45	8	Linear	1.9
225	TA3852LC/LA	38	52	8	Linear	1.5/1.9
300	TC3866LC	38	66	16	Linear	1.5
300	TC3866LA	38	66	16	Linear	1.9
335	TA4456LC/LA	44	56	16	Linear	1.5/1.9
535	TA4878LC/LA	48	78	16	Linear	1.5/1.9
735	TA735XLC/LA	48	103	16	Linear	1.5/1.9
925	TA6281LC/LA	62	81	16	Linear	1.5/1.9
1065	TA1065LC/LA	58	106	16	Linear	1.5/1.9
1300	TA1300LC/LA	62	114	16	Linear	1.5/1.9
1625	TN1625LC/LA	63	134	16	Linear	1.5/1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR POLYETHYLENE ELIPTICAL HORIZONTAL
BULK STORAGE TANKS MC AND MA SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Length (inches)	Width (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73°Fahrenheit
200	TA200XMC/MA	41	66	26	8	Linear	1.5/1.9
300	TA300XMC/MA	48	70	30	8	Linear	1.5/1.9
400	TA400XMC/MA	57	70	36	8	Linear	1.5/1.9
500	TA500XMC/MA	57	82	36	8	Linear	1.5/1.9
500	TC500XMC	80	53	45	16	Linear	1.5
500	TC500XMA	80	53	45	16	Linear	1.9
750	TA750XMC/MA	69	89	42	16	Linear	1.5/1.9
1000	TA1000MC/MA	78	90	49	16	Linear	1.5/1.9
1000	TC1000MC	145	53	45	16	Linear	1.5
1000	TC1000MA	145	53	45	16	Linear	1.9
1035	TA1035MC/MA	78	90	52	16	Linear	1.5/1.9
1235	TC1235MC	125	68	50	16	Linear	1.9
1600	TA1600MC/MA	78	138	49	16	Linear	1.5/1.9
2350	TA2350MC/MA	88	146	63	16	Linear	1.5/1.9
2635	TN2635MC	140	90	71	16	Linear	1.5
2635	TN2635MA	140	90	71	16	Linear	1.9
3200	TA3200MC/MA	88	172	74	16	Linear	1.5/1.9
4035	TN4035MC/MA	192	92	77	16	Linear	1.5/1.9

PASSPORT IBC™

FXSM and FXUM • Steel Pallet — World-class Material Handling Solution

For more information, visit
www.clawsoncontainer.com

QUALITY ASSURED FIRM ISO 9002 SGS

When choosing your IBC packaging, Clawson Container Company recognizes three factors that influence your decision.

Advantage One: **Manufacturing**

- **Quality Assurance** - An ISO 9002 certified manufacturer ensures a consistent reliable product.
- **Highest Output** - Efficient automated manufacturing ensures on time shipping at a competitive price.
- **Regulatory Compliance** - The FXUM is labeled UN 31 HA1 for the handling and transport of Class II and III hazardous materials.

Advantage Two: **Innovation**

- **Pallet** - The steel pallet's nesting design, welded corners and four-way access results in a package that is efficient to handle and can be stacked with virtually all commercial container types and handling systems.
- **Bottle** - Made of blow-molded high-density polyethylene the bottle is compatible with the broadest range of chemicals and food grade products.
- **Cage** - Combining the superior strength of a square tubular design and the patented four-point welding process at each cross bar, we have created a cage that provides dynamic stability under extreme loads.

Advantage Three: **Service**

- **Environmentally Responsible** - *ReturnNet System* global container management program, ensures the proper recycling and handling of *Passport IBCs*.
- **Global Availability** - Through *PacNet*, *Passport IBCs* are available from state-of-the-art facilities and distribution points in the U.S.A., Italy, Spain and Germany.

1-800-325-8700

http://www.clawsoncontainer.com

E-MAIL: info@clawsoncontainer.com

TEL: (248) 625-8700 • FAX: (248) 625-3066

4545 Clawson Tank Drive • Clarkston, MI 48346

RETURNnet SYSTEM
1-888-758-7447

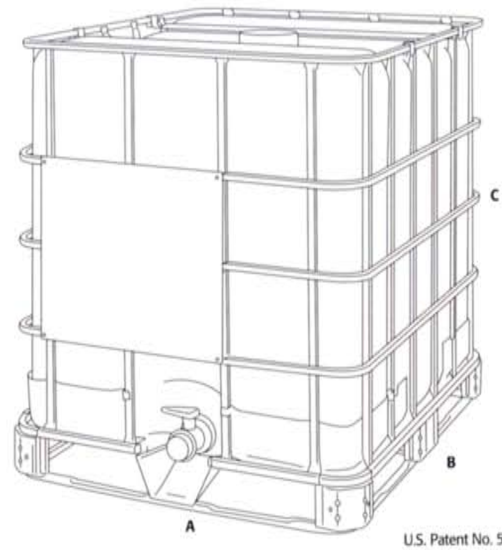
PACnet MEMBER

CLAWSON CONTAINER COMPANY

1020-071000

Passport IBC

Clawson Container Company – Dependability you can count on!



U.S. Patent No. 5645185

For more product information contact Clawson direct.

By Phone: 1-800-325-8700 or (248) 625-8700

Press 1	Sales/Order Placement
Press 2	Customer Service
Press 3	Technical Services

By E-mail:

info@clawsoncontainer.com	General Information
sales@clawsoncontainer.com	Sales/Order Placement
service@clawsoncontainer.com	Customer Service
tech@clawsoncontainer.com	Technical Services

TECHNICAL SPECIFICATIONS

Model No: FXSM and FXUM / Steel Pallet

Capacity	**Nominal**	220-gallon	833-liter	275-gallon	1040-liter	330-gallon	1249-liter
	Actual	218-gallon	825-liter	280-gallon	1060-liter	338-gallon	1279-liter
Dimensions	**Width (A)**	40"	1016 mm	40"	1016 mm	40"	1016 mm
	Depth (B)	48"	1219 mm	48"	1219 mm	48"	1219 mm
	Height (C)	39"	990 mm	46"	1168 mm	54"	1270 mm

Bottle	**VOLUME INDICATOR**	**FILL OPENING (ID)**	**DISCHARGE OPENING (ID)**	**BLOWING MOLDING**
	Molded gallon & liter	5 5/8" 143 mm	2 1/4" 57 mm	High Molecular HDPE/UV

Fill	**DIAMETER**	**MATERIAL**	**GASKET**	**THREAD**
	6"/150 mm	HDPE	Sponge Rubber	Buttress

Discharge	**DIAMETER**	**TYPE**	**MATERIAL**	**GASKET**	**DUST CAP GASKET**	**THREAD**	**TAMPER EVIDENT**
	2"/50 mm	Plunger	HDPE	Viton	Sponge Rubber	NPT	Foil seal/Locking Pin/Thread Seal

Frame	**MATERIAL**	**MANUFACTURING**	**COATING**	**INFORMATION PLATE**
	Tubular Steel Grid	Four-point electro-welded	Zinc Galvanized	19" x 21" / 483 mm x 522 mm

Pallet	**MATERIAL**	**STACKING**	**HANDLING**
	Galvanized stamped sheet steel	Interlocking Safety Design	Four-way Access

Regulatory	**UN LABELING**	**STATIC LOAD**	**DYNAMIC LOAD**	**TEST METHODS**	**MATERIALS**	**SPECIFIC GRAVITY**
** See IBC Handling Guide*	31 HA1	3 High	2 High*	H20 Bath/2.9 PSIG	FDA Approved	1.9

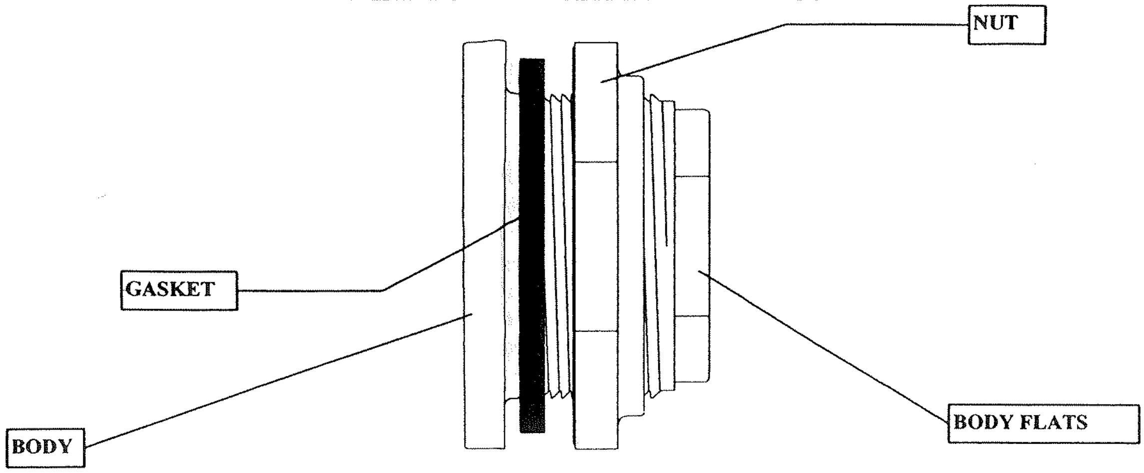
Transport Weights		**220-gallon/833-liter**		**275-gallon/1040-liter**		**330-gallon/1249-liter**	
	Tare Weight	128 lbs.	58 kg.	144 lbs.	65 kg.	160 lbs.	73 kg.
** Actual weights may vary.*	**Gross Weight**	3582 lbs.	1625 kg.	4517 lbs.	2049 kg.	4627 lbs.	2099 kg.

Transport Loads	**SEMITRAILER 48'**	**SEMITRAILER 53'**	**ISO CONTAINER 20'**	**ISO CONTAINER 40'**	**RAIL CAR**
	56 units	60 units	20 units	40 units	up to 150 units

Options	**VALVES AND GASKETS**	**FILL OPENING AND CAPS**	**PALLET / FRAME**
	2" Plunger NPT w/Viton and EPDM	**9" SCREW CAP**	**PALLET**
	2" Plunger NPT / Food Grade	50 mm Buttress Bung	Plastic
	2" Plunger NPT w/EPDM	50 mm Buttress Membrane Vent	Wood
	2" Ball Valve NPT w/Viton or EPDM	**6" SCREW CAP**	**INFORMATION PLATE**
	2" Ball Valve Quick Connect w/Viton or EPDM	2" NPT Bung	28" x 30" /
		50 mm Buttress Membrane Vent	710 mm x 760 mm

HAYWARD INDUSTRIAL PRODUCTS

INSTALLATION DATA FOR SAFE-T-LOC™ BULKHEAD FITTINGS



PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD VALVES, STRAINERS, FILTERS, AND OTHER ASSOCIATED PRODUCTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS INJURY.

1. Hayward guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for damage or injuries resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for damage or injury resulting from chemical incompatibility between its products and the process fluids to which they are subjected. Compatibility charts provided in Hayward literature are based on ambient temperatures of 70 °F and are for reference only. Customer should always test to determine application suitability.
3. Consult Hayward literature to determine operating pressure and temperature limitations before installing any Hayward product. Note that the maximum recommended fluid velocity through any Hayward product is eight feet per second. Higher flow rates can result in possible damage due to the water hammer effect. Also note that maximum operating pressure is dependent upon material selection as well as operating temperature.
4. Hayward products are designed primarily for use with non-compressible liquids. They should NEVER be used or tested with compressible fluids such as compressed air or nitrogen.
5. Systems should always be depressurized and drained prior to installing or maintaining Hayward products.
6. Temperature effect on piping systems should always be considered when the systems are initially designed. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward equipment due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
7. Because PVC and CPVC plastic products become brittle below 40 °F, Hayward recommends caution in their installation and-use below this temperature.
8. Published operating torque requirements are based upon testing of new valves using clean water at 70 °F. Valve torque is affected by many factors including fluid chemistry, viscosity, flow rate, and temperature. These should be considered when sizing electric or pneumatic actuators.
9. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration, and pipe loading forces DIRECT INSTALLATION OF METAL PIPE INTO PLASTIC CONNECTIONS IS NOT RECOMMENDED. Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameter in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.

INSTALLATION INSTRUCTIONS:

The following table, in inches, are recommended values.

Bulkhead size	**Min Rigid** Tank ID	**Min Flexible** Tank ID	**Max** Wall	**Min** Hole	**Max** Hole
1/2"	7.25	5.56	1.08	1.38	1.41
3/4"	10.00	7.75	1.15	1.63	1.66
1"	11.75	8.94	1.15	1.87	1.91
1-1/4"	16.25	12.19	1.02	2.37	2.41
1-1/2"	16.25	12.19	1.02	2.37	2.41
2"	25.75	19.38	1.09	3.25	3.28
3"	42.50	36.25	1.14	4.50	4.54
4"	90.00	76.81	1.69	5.72	5.78

THE SYSTEM AND TANK SHOULD BE DEPRESSURIZED AND DRAINED BEFORE ATTEMPTING TO INSTALL A BULKHEAD FITTING. VENTING AND PROPER PERSONAL PROTECTION EQUIPMENT SHOULD BE USED WHEN ENTERING TANKS.

THE BULKHEAD FITTING SHOULD BE INSTALLED WITH THE BODY AND THE GASKET ON THE INSIDE OF THE TANK. TIGHTEN THE NUT WHILE HOLDING THE BODY. THE NUT CAN BE TIGHTENED FROM THE OUTSIDE OF THE TANK BY HOLDING THE FLATS ON THE BODY END WHILE TURNING THE NUT.

THREADED CONNECTION:

Threaded end connections are manufactured to ASTM specifications D2464-88. F437-88 and ANSI B2.1. Wrap threads of pipe with Teflon tape of 3 to 3-1/2 mil thickness. The tape should be wrapped in a clockwise direction starting at the first or second full thread. Overlap each wrap by, 1/2 the width of the tape. The wrap should be applied with sufficient tension to allow the threads of a single wrapped area to show through without cutting the tape. The wrap should continue for the full effective length of the thread. Pipe sizes 2" and greater will not benefit with more than a second wrap, due to the greater thread depth. To provide a leak proof joint, the pipe should be threaded into the bulkhead fitting "hand tight". Using a strap wrench only. (Never use a stillson type wrench) tighten the joint an additional 1/2 to 1-1/2 turns past hand tight. Tightening beyond this point may induce excessive stress that could cause failure.

SOCKET CONNECTION:

Socket connections are manufactured to ASTM D2467-94. Solvent cementing of socket connections to pipe should be performed per ASTM specifications D2855-87. Cut pipe square. Chamfer and deburr pipe. Surfaces must be cleaned and free of dirt, moisture, oil and other foreign material. Apply primer to inside socket surface. Use a scrubbing motion. Repeat applications may be necessary to soften the surface of the socket. Next, liberally apply primer to the male end of the pipe to the length of the socket depth. Again apply to the socket, without delay apply cement to the pipe while the surface is still wet with primer. Next apply cement lightly, but uniformly to the inside of the socket. Apply a second coat of cement to the pipe, and assemble the pipe into the socket, rotating the pipe 1/4 turn in one direction as it is slipped to full depth of the socket. The pipe should be held in position for approx. 30 seconds to allow the connection to "set". After assembly wipe off excess cement. Full set time is a minimum of 30 minutes at 60 to 100 F. Full cure time should be based on the chart below.

JOINT CURE SCHEDULE:

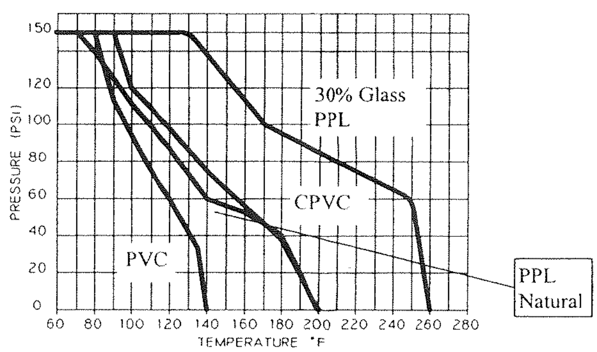
The cure schedules are suggested as guides. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual manufacturer's recommendations for their particular cement should be followed.

	Test Pressures for Pipe Sizes ½" to 1-1/4"		Test Pressures for Pipe Sizes 1-1/2" to 3"		Test Pressures for Pipe Sizes 4" & 5"		Test Pressures for Pipe Sizes 6" to 8"	
Temperature Range During Cure Period(B) °F(°C)	Up to 180 PSI (1240 kPa)	Above 180 to 370 PSI (1240 to 2550 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)
60 to 100 (15 to 40)	1 hour	6 hours	2 hours	12 hours	6 hours	18 hours	8 hours	1 day
40 to 60 (5 to 15)	2 hours	12 hours	4 hours	1 day	12 hours	36 hours	16 hours	4 days
20 to 40 (-7 to 5)	6 hours	36 hours	12 hours	3 days	36 hours (A)	4 days (A)	3 days (A)	9 days (A)
10 to 20 (-15 to 7)	8 hours	2 days	16 hours	4 days	3 days (A)	8 days (A)	4 days (A)	12 days (A)
Colder than 10 (-15)	Extreme care should be exercised on all joints made where pipe, fittings or cement is below 10°F.							

A: It is important to note that at temperatures colder than 20°F on sizes that exceed 3 in., test results indicate that many variables exist in the actual cure rate of the joint. The data expressed in these categories represent only estimated averages. In some cases, cure will be achieved in less time, but isolated test results indicate that even longer periods of cure may be required.

B: These cure schedules are based on laboratory test data obtained on Net Fit Joints (NET FIT=in a dry fit the pipe bottoms snugly in the fitting socket without meeting interference).

NON SHOCK OPERATING PRESSURES



CAUTION:

When installing the bulkhead fitting in a large diameter tank, care should be used to assure the initial thread engagement to the mating part outside the tank, is minimized. This will allow final position of the bulkhead fitting to be adjusted after the tank is filled.

After the tank is filled, if a slight leak develops around the fitting, it may be necessary to slightly loosed the nut and rotate the entire bulkhead body counterclockwise, while holding the mating part stationary. This will draw the bulkhead fitting body toward the inside tank wall. **RETIGHTEN** the bulkhead fitting nut, while holding the flats on the body.

NEW LOGIC
RESEARCH, INC.
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Certificate of Compliance

ASTM D2996-88
Standard Specification for Filament Wound Machine Made Fiberglass Pipe

This letter confirms compliance of provided Filament Wound Fiberglass Pipe per ASTM D-2996-88 standard specification for Filament Wound "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin Pipe) for project use. Though specification ASTM D2996 limits the scope of supply to 16" diameter in size, this specification may be applied to larger sizes where table 2 Physical Property Requirement designation 4 of apparent stiffness would have values different than those listed.

The following filament wound pipe classification is certified per ASTM D2996 by this submission:

RTRP 12EU1-311X (Free Ended Closures)
RTRP 12EW2-311X (Restrained End Closures)

Notes concerning classification digits:

1	Type - Filament Wound
2	Grade 2 - Glass Fiber Reinforced Polyester Resin Pipe
E	Class E - Polyester Resin Liner (reinforced)
1	Free End (Pipe subject to axial end load by end closures)
2	Restrained End (Test Fixture ends react axial pressure load)
U	Static Test Procedure B - Free End hoop stress min 12,500 psi (Testing = 12,500 psi)
W	Static Test Procedure B - Restrained End hoop stress min 16,000 psi (Testing = 16,000 psi)
3	Table 2 Designation Order 1 - short term rupture strength tensile stress min 40,000 psi (Testing = 40,000 psi)
1	Table 2 Designation Order 2 - longitudinal strength tensile stress min 8,000 psi (Testing = 9,000 psi)
1	Table 2 Designation Order 3 - longitudinal tensile modules of elasticity min 1,000,000 psi (Testing = 1,300,000 psi)
W	Table 2 Designation Order 4 - Apparent Stiffness Factor (SF) For resistance to diametrical deflection at 5% deflection minimum 3.16 in2 Value will vary by actual pipe wall thickness and diameter size For 16" diameter 100 psi pipe at 0.26" nominal wall thickness with a 0.10" liner: The minimum apparent stiffness (SF) is determined by: SF = EI = 3300 in3 lbf/in2

Summary of the Design:
The FRP (Fiberglass Reinforced Plastic) housings are used as enclosures for a pressure filtration membrane system component. Elastomeric seals retain the pressure of the liquid and the modules has one inlet and two outlets for process liquid. Design calculations have been validated through developmental pressure testing to 1000 psi stress testing under actual conditions. Further verification has come from actual onsite use by more than 140 customers operating at pressure between 60 psi and 550 psi.

V✧SEP®

NLR doc. 334-91

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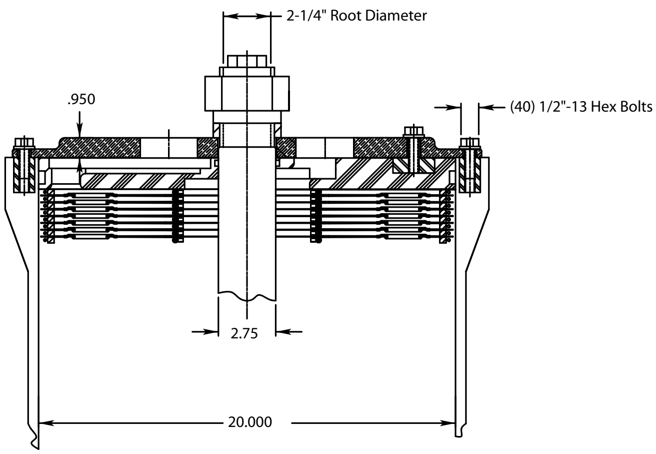
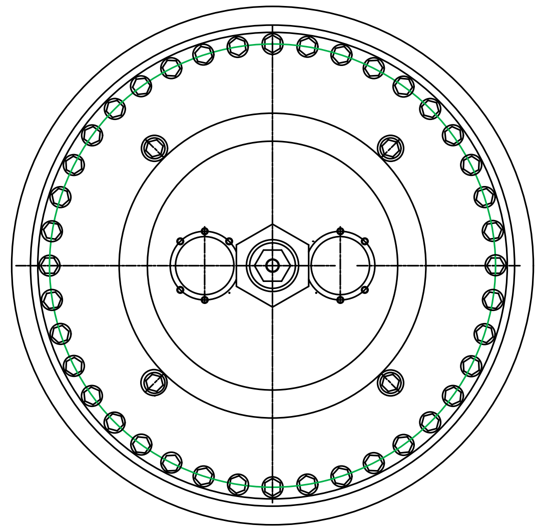
http://www.vsep.com

V✧SEP Filter Pack: Center Bolt Pressure Rating Calculation





Pressure Design Conformance:

The V✧SEP Filter Pack is made using a FRP (Fiberglass Reinforced Plastic), housing which is bonded to stainless steel trays spaced about 1/4" apart to form a monolithic module. the largest unsupported open area is 1/4" thick.

There is an upper and lower Steel Plate that retains the liquid and supports a plastic end plate equipped with o-ring piston seals. A 2-1/2" "Center Bolt is used to hold down the Filter Pack and also acts to retain the pressure exerted on it.

The End Plate Pressure Rating is determined by:

PC =

Where:
- PC = Pressure Class
- p = 3.14
- P = Operating Pressure of the Filter Pack
- A_1 = Area subject to Pressure
- A_2 = Root Cross Section Area of the Center Bolt
- PA_1 = Force
- FS = 2 (per Project Design, could be 1.8)
- Dr = Root Diameter of Bolt
- Ut = Ultimate Tensile Strength of Bar

Solve for A_1:

$A_1 = p \times r^2 = 3.14 \times 10^2 = 3.14 \times 100 = 314$ square inches

Solve for A_2:

$A_2 = p \times r^2 = 3.14 \times 1.125^2 = 3.14 \times 1.26 = 3.97$ square inches

Solve for Applied Stress

Force ÷ Area $= PA_1 \div A_2 = 350$ psi x 314 si ÷ 3.97 si = 27,682 psi

Solve for Safety Factor at 350 psi

Ut ÷ Applied Stress = 180,000 psi ÷ 27,682 psi = 6.5x Overdesign

Solve for Yield Pressure

$A_2 \div A_1 \times Ut = 3.97$ si ÷ 314 si x 180,000 psi = 2,275 psi

The maximum pressure rating for Center Bolt is 2275 psi

Note:Calculations assume no effects of perimeter bolts

Tolerances Unless Otherwise Indicated:
x/x -> ± 1/16"
.x -> ± .100
.xx -> ± .030
.xxx -> ± .005
x° -> ± 30°

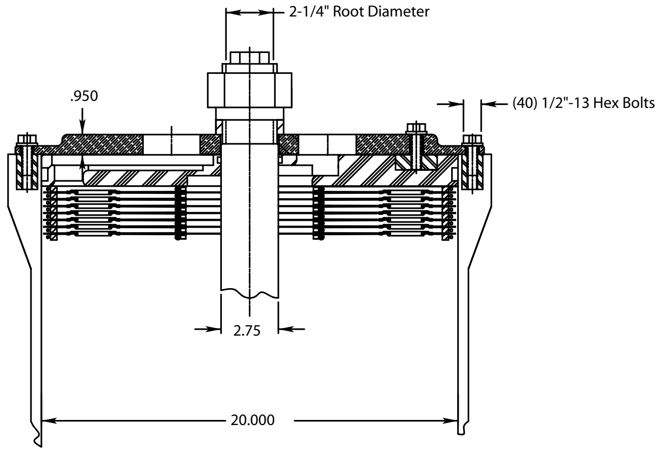
REVISION

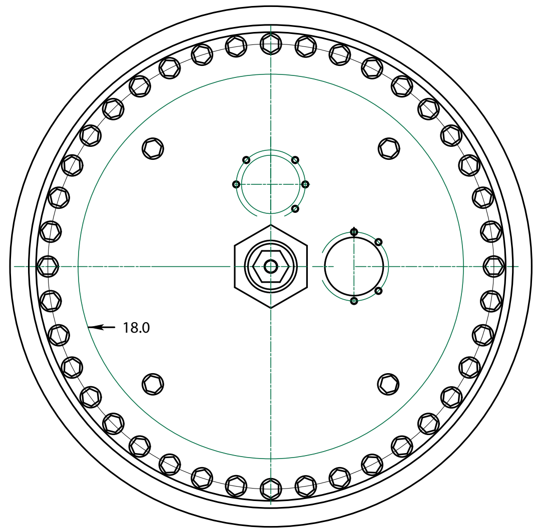
NEW LOGIC RESEARCH, INC.

84" Filter Pack

D	Scale -	i-408-CBPR	A
10/15/01	B. Culkin	G. Johnson	

V✧SEP Filter Pack: End Plate Pressure Rating Calculation





Pressure Design Conformance:

The V✧SEP Filter Pack is made using a Steel Retaining plate for connection of the upper plumbing. The material used is 17-4 pH Stainless Steel and is heat treated to 180 ksi Ultimate Tensile strength.

There is an upper and lower Steel Plate that retains the liquid and supports a plastic end plate equipped with o-ring piston seals. A 2-1/2" "Center Bolt is used to hold down the Filter Pack and also acts to retain the pressure exerted on it.

The End Plate Pressure Rating is determined by:

Given:
- ı = 3.14
- w = Operating Pressure of the Filter Pack
- R = OD Radius
- S_{m1} = Maximum Applied Stress @ 1" thick
- S_{m2} = Maximum Applied Stress @ 1/2" thick
- t = Thickness of steel
- k = Correction Factor (per Marks Engineering Guide)
- Dr = Root Diameter of Bolt
- Ut = Ultimate Tensile Strength of Bar

Solve for S_{m1}:

$$S_{m1} = k \frac{w \times R^2}{t^2} = 1.59 \frac{350 \times 9^2}{.950^2} = 49{,}946 \text{ psi}$$

Solve for S_{m2}:

$$S_{m2} = k_1 \frac{w \times R^2}{t^2} = .122 \frac{350 \times 10^2}{.50^2} = 17{,}080 \text{ psi}$$

Solve for Safety Factor:

The Safety Factor is determined by dividing the applicable material property, Ultimate Tensile Strength, by the actual applied stress.Factors of Safety account for uncertainties with regard to use. Normal Safety Factors for design purposes are between 1.5 and 5.0

Solve for Safety Factor at 350 psi in the 0.950" thick Section

Ut ÷ Applied Stress = 180,000 psi ÷ 49,946 psi = 3.6x Overdesign

Solve for Safety Factor at 350 psi in the 0.50" thick Section

Ut ÷ Applied Stress = 180,000 psi ÷ 17,080 psi = 10.5x Overdesign

Solve for Burst Pressure

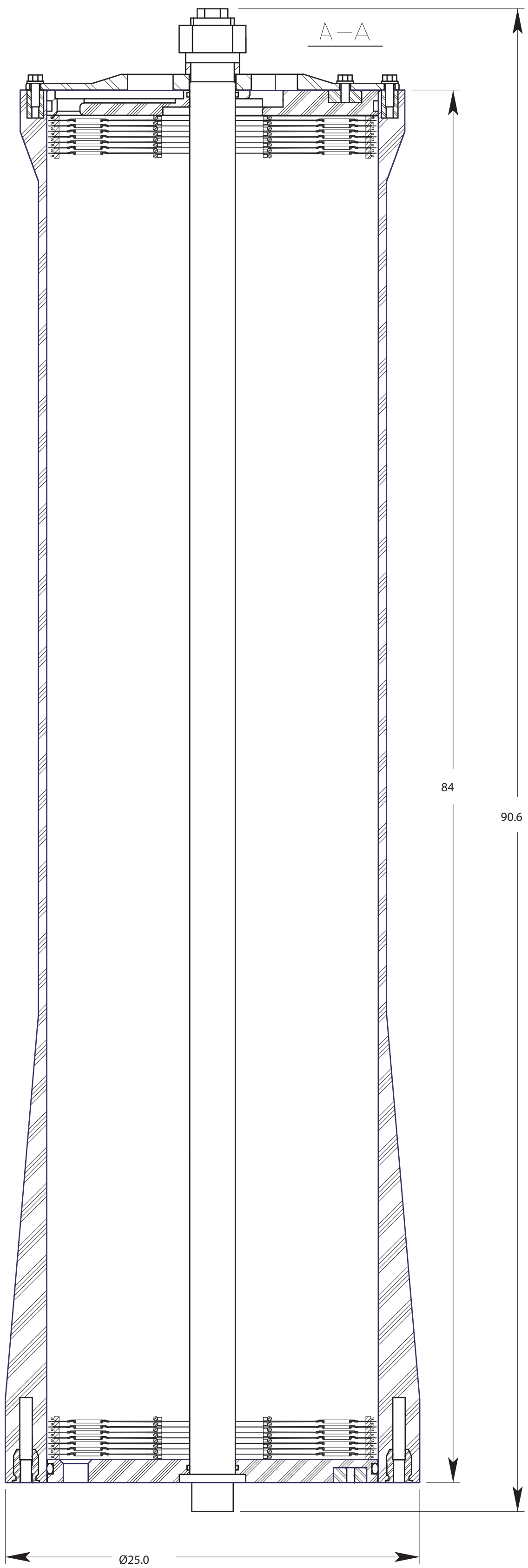
$$w = \frac{U_t \times t^2}{k \times R^2} = \frac{180{,}000 \times 950^2}{1.59 \times 9^2} = 1{,}261 \text{ psi}$$

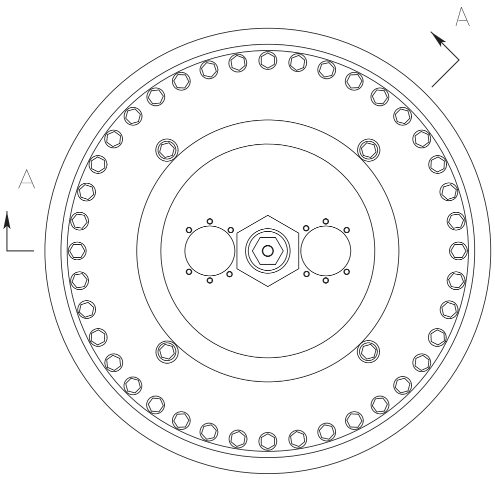
Note:Formula is taken from Marks' Standard Handbook for Mechanical Engineers 10th Edtition Section 5-48

The Steel End Plate is capable of withstanding 1,261 psi

Tolerances Unless Otherwise Indicated: x/x -> ± 1/16" .x -> ± .100 .xx -> ± .030 .xxx -> ± .005 x° -> ± 30°	REVISION	NEW LOGIC RESEARCH, INC.			
		84" Filter Pack			
		D	Scale -	i-408-EPPR	A
		10/15/01	B. Culkin	G. Johnson	

V-SEP Filter Pack: Pressure Rating Calculation





Pressure Design Conformance:

The VSEP Filter Pack is made using a FRP (Fiberglass Reinforced Plastic), housing which is bonded to stainless steel trays spaced about 1/4" apart to form a monolithic module. the largest unsupported open area is 1/4" thick.

The FRP pipe is designed and manufactured in accordance with the requirements of ASTM D2996. The pipe is based on a design life of 50 years based on ASTM D2992 Procedure B. The design pressure rating is calculated based on data from ASTM 2992 and is based on a minimum wall thickness of .75"

The FRP pipe is designed with 45º filament hoop wound glass fibers and 8084 Dow Derekane® vinyl ester resin. The following calculation is for the FRP pipe only and does not add any pressure rating strength for the bonding of steel reinforcing trays spaced every 1/4"

The Long Term Pressure Rating is determined by:

$$PC = \text{Lths} \times \text{Tks} \times \frac{2}{FS} \times \frac{1}{D_m}$$

Where:
- PC = Pressure Class
- Lths = 12,500 psi (Free End) or 16,000 psi (Restrained End)
- Tks = Minimum Wall Thickness (Inches)
- FS = 2 (per Project Design, could be 1.8)
- D_m = Mean Diameter

Solve for Pressure Rating:

$$PC = 16{,}000\text{ psi} \times 1.2" \times \frac{2}{2} \times \frac{1}{20.75"}$$

$$PC = 12{,}000 \times 1.2 \times 0.04819$$

$$PC = 925\text{ psi}$$

The design pressure rating for VSEP Filter Packs is 925 psi

NLI doc 334-90

Tolerances unless otherwise indicated:
x/x -> ±1/32
.x -> ±.100
.xx -> ±.030
.xxx -> ±.005
x° -> ±30'

REVISION

NEW LOGIC

84" Filter Pack

D | Scale – | i-408 | A

10/11/97 | B.CULKIN | G Johnson

NLR Welding Procedures

GMAW (Mig) Procedure for Structural Carbon Steel

Powcon Mig machine set for short circuit welding – 75% Argon, 25% Carbon Dioxide gas shield

AWS A5.18, ASME SEA 5.18 ER 705-3

.035 Electrode wire, Lincolon L-50

Structural parts are fit and tacked into place according to print specs and tolerance. They are then finish welded using single and multiple pass weld applications. Sections of work are stress relieved as per engineering requirements. Finish work is then sanded and cleaned for powdercoating.

GTAW (Tig) Procedure for SS Piping

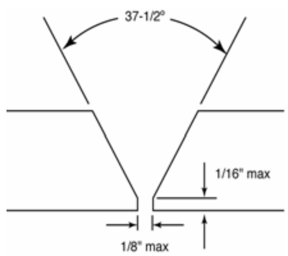
Lincoln Square Wave Tig 350 Machine

100 % Argon gas shield and Argon back gas purge. Type ER 316L SS Rod

Pipe sections are fit up using tack and bolt up procedures. Sections are then mocked up and assembled on the skid to check for fit and alignment. After approval they are then disassembled and finish welded using fillet and multiple pass weld process. Sections of work are stress relieved as per engineering requirements. All work is brush cleaned and prepared for electro-polish.

MIG Welding Specification

V-SEP Membrane Filtration System
New Logic, 1295 67th Street, Emeryville, CA 94

		Spec No.	**MIG-001**
		Date	4/14/2006
		Sheet	1 of 1
Project:		**NLR Approved by**	
		New Logic	Greg Johnson
		New Logic	Kevin Neeley
Client Info		**Client Approved by:**	
Groove Design Used		**Base Metal**	
		Material Specification	SA 53
		Type or Grade	**A36 Carbon**
			p No.1 to p No. 1
		Thickness	.12 w
		Diameter	N/a
		Other:	
Filler Materials		**Position**	
Weld Metal Analysis A I	1	Position of Groove	6G
Size of Electrode	0.035	Weld Progression	Uphill
Filer Metal F No.	6	Other:	
SFA Specification	5.18		
AWS Classification	E 70S-3		
Other	n/a		
Post Weld Treatment		**Gas**	
Temperature	n/a	Type of Gas or Gases	Argon/Carbon Dioxide
Time		Gas Mixture	75%/25%
Other		Other:	
Electrical Characteristics		**Technique**	
Current	D.C.	String or Weave Bead	String
Polarity	Reverse	Oscillation	n/a
Amps	190	Multiple or Single Pass	Mulitple
Volts	29	Single or Multiple Electr	Single
		Travel Speed	10"/min
Approved By:	Greg Johnson	**Date:**	4/14/2006
Print Name		**Company:**	

TIG Welding Specification

V-SEP Membrane Filtration System
New Logic, 1295 67th Street, Emeryville, CA 94

Spec No.			**TIG-001**
		Date	4/14/2006
		Sheet	1 of 1

Project:		**NLR Approved by**	
		New Logic	Greg Johnson
		New Logic	Kevin Neeley
Client Info		**Client Approved by:**	
Groove Design Used		**Base Metal**	
		Material Specification	SA 312
		Type or Grade	**TP 304**
		P No. 8	to p No. 8
		Thickness	Schedule 40 & 80
		Diameter	1" to 4"
		Other:	
Filler Materials		**Position**	
Weld Metal Analysis A I	8	Position of Groove	6G
Size of Electrode	3/16" to 3/32"	Weld Progression	Uphill
Filer Metal F No.	6	Other:	
SFA Specification	5.9		
AWS Classification	ER 308		
Other	ER 316L		
Post Weld Treatment		**Gas**	
Temperature	n/a	Type of Gas or Gases	Argon
Time		Gas Mixture	100%
Other		Other:	
Electrical Characteristics		**Technique**	
Current	D.C.	String or Waeve Bead	String
Polarity	Straight	Oscillation	None
Amps	75/100	Multiple or Single Pass	Mulitple
Volts	20/30	Single or Multiple Electi	Single
		Travel Speed	
Prepared By:	Greg Johnson	Date:	4/14/2006
Approved By:		**Date:**	
Print Name		**Company:**	

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Victor Freeman   Identification No. ______

Test Description

Identification of WPS followed: B31.3 (a-c)   ☐ Test Coupon   ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L   Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1: .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1: N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A   Length and percent of defects ______

Macro examination (QW-184): N/A   Fillet size (in): N/A   Concavity/convexity (in): N/A

Other tests

Film or specimens evaluated by: Bruce Sherman   Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman   Laboratory test no.: 10-005

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/10/2010   By: [signature]

AWS
BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB13055

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Ramon Moreno   Identification No.:

Test Description

Identification of WPS followed: B31.3 (a-c)   ☐ Test Coupon   ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L   Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1:___ .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1:___ N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A   Length and percent of defects:

Macro examination (QW-184): N/A   Fillet size (in): N/A   Concavity/convexity (in): N/A

Other tests:

Film or specimens evaluated by: Bruce Sherman   Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman   Laboratory test no.: 10-006

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/112/2010   By: [signature]

AWS
BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB 13055

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Victor Freeman Identification No. ______

Test Description

Identification of WPS followed: B31.3 (a-c) ☐ Test Coupon ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1: .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1: N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A Length and percent of defects: ______

Macro examination (QW-184): N/A Fillet size (in): N/A Concavity/convexity (in): N/A

Other tests: ______

Film or specimens evaluated by: Bruce Sherman Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman Laboratory test no.: 10-005

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/10/2010 By: ______

AWS
BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB13055

WELDING PROCEDURE SPECIFICATION (WPS) ☑ Yes

PREQUALIFIED NO **QUALIFIED BY TESTING** YES

or PROCEDURE QUALIFICATION RECORDS (PQR) ☐ Yes

Identification # GMAW-S-2
Revision 0 Date ####### By B. Sherman
Authorized by M. Ayers Date 2/11/2010
Type-- ☐ ManualYe ☑ Semi-Automatic ☐ Machine ☐ Automatic

Company Name New Logic Research Inc.
Welding Process(es) GMAW-S
Supporting PQR No.(s) GMAW-S-2

JOINT DESIGN USED

Type: Tee Joint
☑ Single ☐ Double W
Backing ☑ Yes ☐ No
Backing Material Base Metal
Root Opening 0" Root Face Dim. N/A
Groove Angle N/A Radius (J-U) N/A
Back Gouging ☐ Yes ☑ No Method

POSITION

Position of Groove N/A Fillet 1F, 2F
Vertical Progression y☐ Up ☐ Down

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW) ☑ Short-Circuiting ☐ Globular ☐ Spray
Current ☐ AC ☑ DCEP ☐ DCEN ☐ Pulsed
Other
Tungsten Electrode (GTAW) N/A
Size
Type

BASE METALS

Material Spec All Group 1(Table 3.2)
Type or Grade
Thickness Groove N/A Fillet 1/8"- 1/2"
Diameter (Pipe) All

TECHNIQUE

Stringer or Weave Bead Stringer
Multi-pass or Single Pass (per side) Single
Number of Electrodes 1 Longitudinal N/A
Lateral N/A
Angle N/A

FILLER METALS

AWS Specification A5.18
AWS Classification ER70S-3

SHIELDING

Flux Gas Ar-CO2
Comp. 75-25%
Electro-Flux (Class) Flow Rate 40cfh
Gas Cup Size

Contact Tube to Work Distance 1/4-1/2"
Peening none
Interpass Cleaning none

PREHEAT

Preheat Temp. Min. 32 deg. F
Interpass Temp. Min. 32 deg. F Max. 600 deg. F

POSTWELD HEAT TREATMENT None

Temp.
Time

WELDING PROCEDURE

Pass or Weld Layers	Process	Filler Metals Class	Filler Metals Diam.	Current Type & Polarity	Current Amps or Wire Feed Speed	Volts	Travel Speed	Joint Details
1- all	GMAW	ER70S-3	.035"	DC+	420 ipm	22	10 ipm	Tee Jt.

WELDING PROCEDURE SPECIFICATION (WPS) ☑ Yes

PREQUALIFIED NO **QUALIFIED BY TESTING** YES

or PROCEDURE QUALIFICATION RECORDS (PQR) ☐ Yes

Identification # GMAW-S-2

Revision 0 Date ####### By B. Sherman

Company Name New Logic Research Inc.

Authorized by M. Ayers Date 2/11/2010

Welding Process(es) GMAW-S

Type-- ☐ ManualYe ☑ Semi-Automatic ☐ Machine ☐ Automatic

Supporting PQR No.(s) GMAW-S-2

JOINT DESIGN USED

Type: Tee Joint

☑ Single ☐ Double W

Backing ☑ Yes ☐ No

Backing Material Base Metal

Root Opening 0" Root Face Dim. N/A

Groove Angle N/A Radius (J-U) N/A

Back Gouging ☐ Yes ☑ No Method

POSITION

Position of Groove N/A Fillet 1F, 2F

Vertical Progression y☐ Up ☐ Down

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW) ☑ Short-Circuiting ☐ Globular ☐ Spray

Current ☐ AC ☑ DCEP ☐ DCEN ☐ Pulsed

Other

Tungsten Electrode (GTAW) N/A

Size

Type

BASE METALS

Material Spec All Group 1(Table 3.2)

Type or Grade

Thickness Groove N/A Fillet 1/8"- 1/2"

Diameter (Pipe) All

FILLER METALS

AWS Specification A5.18

AWS Classification ER70S-3

TECHNIQUE

Stringer or Weave Bead Stringer

Multi-pass or Single Pass (per side) Single

Number of Electrodes 1 Longitudinal N/A

Lateral N/A

Angle N/A

Contact Tube to Work Distance 1/4-1/2"

Peening none

Interpass Cleaning none

SHIELDING

Flux Gas Ar-CO2

Comp. 75-25%

Electro-Flux (Class) Flow Rate 40cfh

Gas Cup Size

PREHEAT

Preheat Temp. Min. 32 deg. F

Interpass Temp. Min. 32 deg. F Max. 600 deg. F

POSTWELD HEAT TREATMENT None

Temp.

Time

WELDING PROCEDURE

Pass or Weld Layers	Process	Filler Metals: Class	Filler Metals: Diam.	Current: Type & Polarity	Current: Amps or Wire Feed Speed	Volts	Travel Speed	Joint Details
1- all	GMAW	ER70S-3	.035"	DC+	420 ipm	22	10 ipm	Tee Jt.

PROCEDURE QUALIFICATION RECORD (PQR) # GMAW-S-2

Test Results

TENSILE TEST N/A

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load, lb	Ultimate Unit Stress, psi	Character of Failure and Location

GUIDED BEND TEST N/A

Specimen No.	Type of Bend	Result	Remarks

VISUAL INSPECTION

Appearance: Acceptable
Undercut: None
Piping porosity: None
Convexity: Acceptable
Test date: 2/20/2010
Witnessed by: Matt Ayers

Radiographic-ultrasonic examination N/A
RT report no.: ______ Result ______
UT report no.: ______ Result ______

FILLET WELD TEST RESULTS

Minimum size single pass
Macro etch
1 Pass 3 Pass
2 Pass

Minimum size mulitple pass
Macro etch
1 N/A 3 N/A
2 N/A

Other Tests

All-weld-metal tension test: N/A
Tensile strength, psi: N/A
Yield point/stregth, psi: N/A
Elongation in 2 in. %: N/A
Laboratory test no.: 10-008

Welder's name: Ramon Moreno
Clock no.: ______
Stamp no.: ______
Tests conducted by: Bruce Sherman
Laboratory: Bruce Sherman SCWI
Test number: 10-008
Per: 4.2

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Section 4 of AWS D1.1/D1.1M 2008 Structural Welding Code-Steel
(year)

Signed: New Logic Research Inc.
Manufacturer or Contractor

By: [signature]
Title: Plant Manager
Date: 2-23-10

WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Type of Welder: Welder

Name: Victor Freeman — Identification No.:

Welding Procedure Specification No.: GMAW-S-1 — Rev: 0 — Date: 2/20/2010

Variables	Record Actual Values Used in Qualification	Qualification Range
Process/Type [Table 4.12, Item (1)]	GMAW-S	GMAW-S
Electrode (single or multiple) [Table 4.12, Item (7)]	Single	Single
Current Polarity	DC Rev	
Position [Table 4.12, Item (4)]	2F	1F,2F
Weld Progression [Table 4.12, Item (5)]	Backhand	Backhand only
Backing (YES or NO) [Table 4.12, Item (6)]	Yes	
Material Spec.	A-36 to A-36	All M-1 matl.
Base Metal		
Thickness (Plate)	1/2"	Unlimited
Groove	N/A	
Fillet	5/16"	All Sizes
Thickness (Pipe/Tube)	N/A	
Groove	N/A	
Fillet		All T
Diameter (Pipe)	N/A	
Groove	N/A	
Fillet	N/A	All Diameters
Filler Metal (Table 4.12)		
Spec. No.	5.18	
Class	ER70S-3	ER70S-X
F-No. [Table 4.12, Item (2)]	6	6
Gas/Flux Type (Table 4.12)	Ar 75%-CO2 25%	
Other		

VISUAL INSPECTION (4.8.1)

Acceptable YES OR NO: Yes

Guided Bend Test Results (4.30.5)

Type	Result	Type	Result

Fillet Test Results (4.30.2.3 and 4.30.4.1)

Appearance: Acceptable — Fillet Size: 5/16"

Fracture Test Root Penetration: Full to root — Macroetch: Acceptable

(Describe the location, nature, and size of any crack tearing of the specimen.)

Inspected by: B.Sherman — Test Number: 10-009

Organization: Bruce Sherman SCWI — Date: 2/20/2010

RADIOGRAPHIC TEST RESULTS (4.30.3.2)

Film Identification Number	Results	Remarks	Film Identification Number	Results	Remarks

AWS BRUCE S. SHERMAN SCWI 99100868 QC1 EXP. 10/01/11

Interpreted by — Test Number

Organization Bruce Sherman — Date

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Section 4 of AWS D11.1/D1.1M 2008 (year) Structural Welding Code-Steel

Manufacturer or Contractor: New Logic Research — Authorized by: Matt Ayers

Date: ## 2/20/10 2-23-10

NEW LOGIC INTERNATIONAL
1295 67th Street, Emeryville, California, U.S.A 94608 (510) 655-7305 fax-(510) 655-7307

Epoxy Powdercoating Procedures

1. Part will arrive at vendor's shop clean and free of grease or machine oil.

2. Sandblast part using 0.060" garnet aluminum oxide media. Complete coverage is required. White Metal.

3. Part is to be preheated in preparation to receive coating. Preheating will be at 400°F for approximately 60-90 minutes. Heating time is proportional to the mass of the part. Check part readiness with non-contact thermometer gun for 400°F. DO NOT EXPOSE TO HEAT OVER 450°F.

4. ASA-61 Gray Epoxy coating will be sprayed onto the part. Uniform thickness of 0.010" is required.

5. General inspect for thickness, uniformity of coverage, or defects (i.e. pinholes)

6. Part will be cured in an oven at 400°F for a period of time sufficient to complete the curing process of the coating.

7. Inspect for complete cure with MEK rag wipe.

8. Allow part to sufficiently cool. Call New Logic for pick-up.

These procedures are to be followed without exception. Each part will arrive with a document which will need to be signed verifying that all of the procedures and inspections listed above have been performed and passed.

NEVER HEAT THESE PARTS ABOVE 450°F UNDER ANY CIRCUMSTANCE.

Upon returning to New Logic, each part will be tested as follows:

1. Hardness test
2. Thickness test
3. MEK Rag Wipe Cure test

Accepted by: [signature] New Logic International [signature] Poly Engineering

Technical Information Sheet

ALESTA®
Powder Coatings

NUMBER: *EFH400S9* *JULY 15, 1997*

NAME: *ASA 61 GRAY* *TYPE:* Epoxy

POWDER PROPERTIES

ASTM D5965-96, C	Specific Gravity	1.6 ± 0.05
	Theoretical Coverage	120 ft^2/lb/mil
ASTM D3451-92, 13	Mass Loss During Cure	< 1%
	Maximum Storage Temp.	75 °F

COATING PROPERTIES

ASTM D523-89	Gloss at 60°	82+
DPC TM 10.219	PCI Powder Smoothness	6
ASTM D2454-95	Overbake Resistance, Time	100%
ASTM D3363-92a	Pencil Hardness	3H-4H
ASTM D2794-93	Dir / Rev Impact, Gardner	160 / 160 in/lbs
ASTM D3359-97	Adhesion, Cross Hatch	5B Pass
ASTM D522-93a	Flexibility, Mandrel	1/8 in. dia., no fracture
ASTM B117-97	Salt Spray	1,000 hrs
UL DTOV2 Organic Coating	Steel Enclosures, Elect. Eq.	Recognized
Chrysler MS-PE16-2	Underbody	Pass

APPLICATION

Electrostatic Spray, Cold
Substrate: 0.032 in. CRS
Pretreatment: Bonderite® 1000, Parcolene® 60

CURE SCHEDULE:
(Time at substrate temperature)
8 Minutes @ 400°F

FILM THICKNESS: 2.0-2.5 Mils

This product is authorized for use on submarine components having a maximum use temperature of 125°F. This product is close in color to American National Standards, ANSI 61.

Prepared 4/23/2003

9800 Genard Rd. Houston, TX 77041-7624 1-800-247-3886 fax: 713-939-4027
4130 Lyman Ct. Hilliard, OH 43026-1213 1-800-667-9610 fax: 614-771-4139

POWDER COATED TOUGH ISO 9001

WARRANTY POLICY: DuPont Powder Coatings U.S.A., Inc. (Seller) certifies that all coatings delivered to purchaser in unopened factory filled containers meet all pertinent quality standards presented in its current published literature. Since matters of surface preparation, application procedures, curing procedures and other local factors that affect coating performance are beyond Seller's control, Seller assumes no liability for coating failure other than to supply replacement material for a coating material proven to be defective. Do not use this product until the current Material Safety Data Sheet has been read and is fully understood. Seller will not be liable for any injuries, damages or other losses derived, directly or indirectly, from or as a consequence of purchaser's use of the product. Purchaser will determine suitability of this product for its use and thereby assumes all risks and liabilities in connection therewith. [DUPONT POWDER COATINGS DISCLAIMS ALL OTHER WARRANTIES RELATING TO ITS PRODUCTS, AND DISCLAIMS ALL WARRANTIES RELATING TO THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES.]

DUPONT
The miracles of science

Revision By D.S.M.

Specification Number Approved R.S.D.
007
Revised 5-1-93

MANUFACTURING PROCESS SPECIFICATIONS

Scientific Platers Specification on S.P.I. Processing (Chemical Purity of Metal)

I. DESCRIPTION

1. INTRODUCTION

1.1 Scope and Application

This specification covers the requirements for surface treatment of metals by S.P.I. Processing in which the parts to be cleaned or polished are made anodic in the Power-Kleen electrolyte solution and cleaning or polishing is accomplished by the removal of the amorphous, thermal stressed skin on all metals, which is the base of contamination.

1.2 S.P.I. Processing may be used when improved RMS surface finish, surface decontamination, sizing and deburring, reduced friction and/or greater corrosion resistance is required.

(a) Pre-Weld, Pre-Braze and Pre-Solder conditioning of surfaces.

(b) Surface stresses and strains removal.

(c) Galling elimination of threaded parts.

(d) Mercury and Hydrogen purging.

(e) Non destructive inspection; detection of: mal-heat treat and anneal in 17-4PH, 17-7PH, and 400 series stainless steel; of carburization in 200 and 300 series stainless steel; undesirable chemical changes of INCONELL X which occurs through introduction of titanium, aluminum and molybdenum in oven aging; of high carbon content or non-compatible alloys; of chromium carbide condition in 300 series stainless steel.

(f) Increase adhesion of plating and other coatings up to 300%.

(g) Completely compatible with atomic fuels, i.e., hydrogen peroxide, liquid oxygen, fuming nitric acid, fluorine, etc.

1.3 S.P.I. Processing in conformance to this specification may be performed on corrosion resistant steel alloys, heat resistant steel alloys, and high temperature alloys containing 12% or more chromium. Alloys other than these must have the approval of Metallurgical Department.

1.4 Under no circumstances can any parts be processed in an electrolyte solution containing hydros, nitros, halogens, chromics or organics. Such solutions create an ionization of destructive nature to weldments and parent metal causing intergranular attack.

II APPLICATION

The application of this specification is limited to the metals for which there is Confidential Supplement* to describe the method of processing. Other metals shall not be subjected to S.P.I. Processing without prior approval of the Metallurgical Department.

This process may be used whenever the following conditions are desired:

(a) High luster polished surface - Stock metal removed usually 0.0001 to 0. 0003; however, metal removed may be controlled and hold concentricity from 50 millionths of an inch up to the ± tolerance size according to Engineering requirements.

(b) Matte finish - obtained by glass bead honing followed by light S.P.I. Processing or by otherwise varying the S.P.I. Process.

(c) Corrosion Resistance - Stainless steels (300 Series) exhibit high degree of passivation exceeding requirements of Mil. S-5002. (Excess of 3000%)

(d) Chemically pure and surgically clean surface - May be used for LOX clean refer to Confidential Supplement* for handling procedure or prior to LOX cleaning.

III LIMITATIONS

(a) Aluminum alloys (See Alumpure processing).

(b) Assemblies with faying surfaces except with concurrence of applicable Manufacturing Specifications.

(c) Special tooling required for parts with deeply recessed areas.

(d) Parts with close tolerances except when the maximum allowable amount of metal removed is specified.

IV S.P.I. PROCESSING PROCESS

4.1 Type I - High luster, bright polish, stock removal .0001 to .001 inches for machined surfaces.

4.1.A Type I-A - Raw castings - Removal of casting skin, stock removal 0.001 to 0.003 per surface.

4.2 Type II - S.P.I.-etch - matte finish as a base for further processing obtained by grit blasting or honing followed by a light S.P.I. Process.

4.3 Type III - Burr removal - Stock removal of .00005 to .00015 measured on an externally machined surface.

4.4 Type IV - Reverse plating - for improved wear properties after grinding or honing or plated coatings. No measurable dimensional change is allowable.

4.5 Type V - Bright polish on welded assemblies; stock removal 0.0001 to 0.0005.

4.6 Type I parts shall have a smooth, high luster, uniformly-bright surface. 200 Series, 300 Series, 21-6-9 414 and 431 steels and precipitation hardenable alloys shall be capable of passing 48 hours of salt spray testing per QQ-M-151.

4.7 Type II shall have a matte finish, uniformly high luster. Type II parts shall be capable of passing 48 hours of salt-spray testing per QQ-M-151.

V PROCESS

5.1 Prior to S.P.I. Process, parts shall be cleaned free of contaminants, scale or other adherent materials. Cleaning may be accomplished by any applicable method which will produce clean parts, but not affect them chemically or physically. Pickling on steels subject to inter-granular corrosion is specifically prohibited (PH steels, AM-350, AM-355, 17-7, 17-4, 15-7, moly, 718, inconell and refractory metals)

5.2 Areas not to be S.P.I. Processed may be masked.

5.3 Temperature control of Power-Kleen solution must not exceed 175° F.

5.4 Rinsing operations shall be complete. Residual acids or other process solution chemicals shall not be left on components.

5.5 S.P.I. processed parts shall exhibit inactive surfaces unless an active surface is required and stated on the applicable Purchase Order.

5.6 S.P.I. Processing may be accomplished by an applicable process provided the finished product meets the quality requirements of this specification.

VI QUALITY ASSURANCE

6.1 To assure adequate performance characteristics, vendor's capability shall be approved by purchaser before material for production is treated.

6.1.1 Purchaser will supply test samples approximately 0.25x1x6 inches of 17-4 PH steel machined to 100-125 R. M. S. finish on all surfaces. Vendor shall S.P.I. Process test specimens and submit to purchaser's quality control for approval.

6.1.2 Test specimens shall be inspected for a bright appearance and for absence of any surface imperfections, pitting, resulting from the cleaning or polishing operation. Specimens shall be subjected to 8 hour oxygenated water corrosion test. Any evidence of corrosion visible to the unaided eye shall be cause for rejection.

VII INSPECTION

Parts shall be inspected for dimensions and smoothness specified on the engineering drawing and conformance with quality requirements.

NEW LOGIC
RESEARCH, INC.

CE EC Declaration of Conformity

This letter confirms compliance of the VSEP Membrane Filtration Equipment with the European Community directives for CE marking. The listed product models below were tested and determined to be in compliance with all applicable directives, provided that they are used according to our Advisory Technical File dated 7-1-2009.

CE directive classifications:	2004/108/EEC (Electromagnetic compatibility) 2006/95/EEC (Safety/Low Voltage) 2006/42/EC (Machinery)
Standards:	EN 61000-6-2 : 2005 EN 60730
Manufacture:	New Logic Research, Inc 1295 67th Street Emeryville, CA 94608 510-655-7305 info@vsep.com (e-mail) http://www.vsep.com
Models:	VSEP Series I, Series P-50, Series LP, RotoSep50, RotoSep4 S-255, S-850, S-1600, S-3200, S-7200, S-18000, S-36000
Year:	2010
Place:	Emeryville, CA, USA
Signature:	
Full Name:	Gregory Johnson
Position:	CEO

V*SEP

NLR doc. 334-91
V*SEP is a registered trademark
Patents pending

Intertek ETL SEMKO

CLASSIFICATION AUTHORIZATION TO MARK

This authorizes the application of the Certification Marks shown below to the models described in the Products(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to the multiple listee model(s) identified on the correlation page of the Listing Report.

Applicant: *New Logic Research Inc.*
1295 67th Street
Emeryville, CA 94608, USA

Contact: Name: *Greg Johnson* Phone: *(510) 655-7305*
Fax: *(510) 655-7307*

Manufacturer: *New Logic Research Inc.*
1295 67th Street
Emeryville, CA 94608, USA

Party Authorized To Apply Mark: *Same as Manufacturer*

Report Issuing Office: *Intertek, 1365 Adams Court, Menlo Park, CA 94025*

Report No.: *3099390MPK-001*

Product Covered: *V-SEP Filtration System, Models LP Series, P-50 Series and I Series*

Description: *The V-SEP (Vibratory Shear Enhanced Process) is a membrane filtration system as an enhanced liquid/solid separation process used in variety of industries including wastewater treatment, industrial and chemical processing, food waste, pulp and paper, oil and gas production and processing. The equipment is intended for use in an ordinary (non-classified location).*

Standard(s): *Electrical Standard For Industrial Machinery (NFPA 79, 2002 Edition)*
Standard for Safety for Industrial Control Panels (UL 508A, 1st Edition, 04/25/2001)

This document is the property of Intertek Testing Services and is not transferable. Only the Applicant may reproduce this document. The certification mark(s) may be applied only at the above noted location of the Party Authorized To Apply Mark.

INTERTEK ETL LISTED US

Authorized by: for Michelle Lake **Date:** 24/04/06

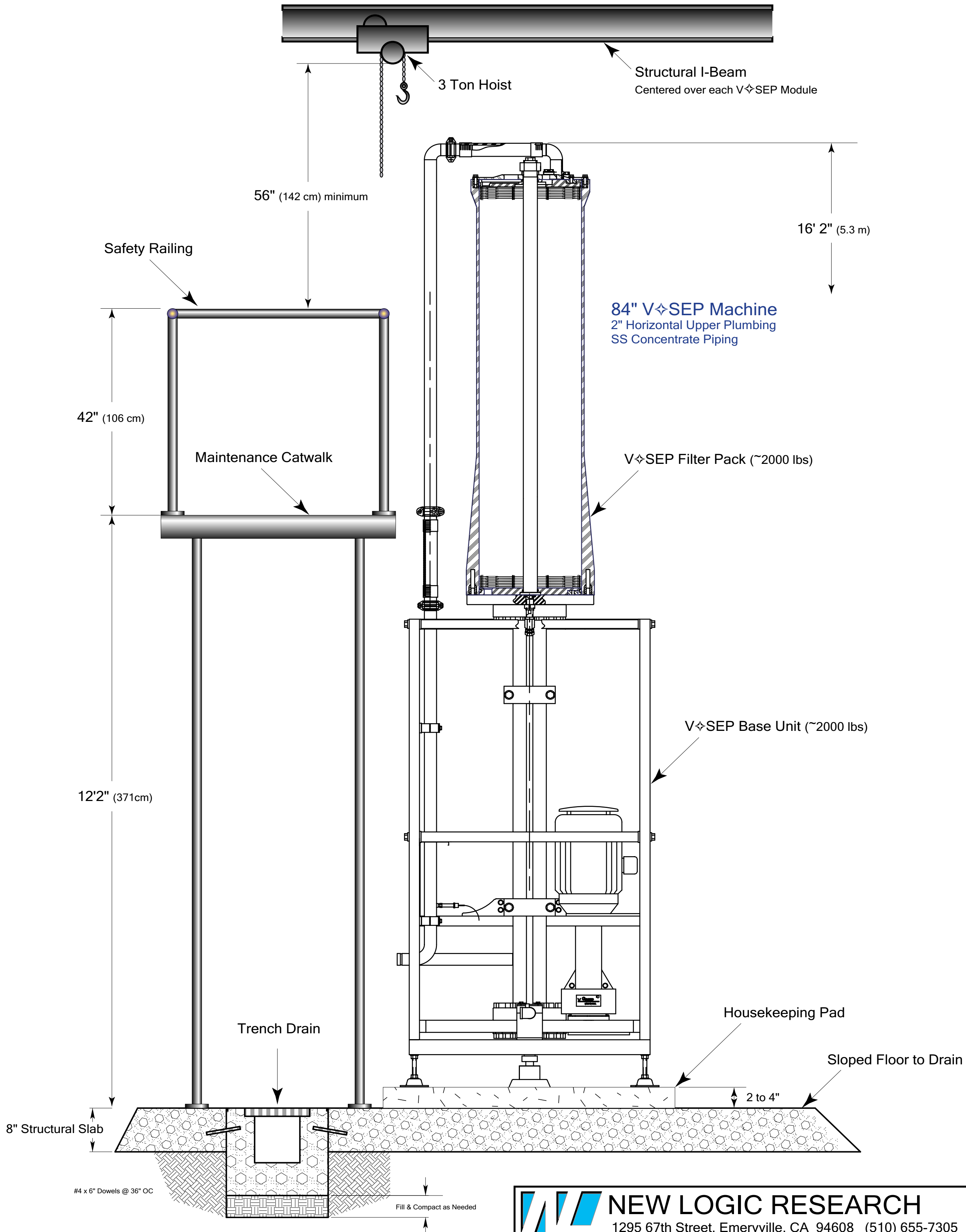
William T. Starr, Certification Manager

Control Number: 3082755

This document supersedes all previous Authorizations to Mark for the noted Report number.

Intertek Testing Services NA Inc.
165 Main Street, Cortland, NY 13045
Telephone 800-345-3851 or 607-753-6711 Fax 607-756-6699

V✧SEP Structural Building Components



NEW LOGIC RESEARCH
1295 67th Street, Emeryville, CA 94608 (510) 655-7305

	Figure 17	09/21/11
84" V✧SEP Cross Section and Building Structure Components		

Confidential Material

Conversion Data

Pressure

from \ to	psi	Kg/cm^2	kPa	BAR
psi	1	.07031	6.895	.0689
Kg/cm^2	14.22	1	98.05	.981
kPa	.1451	.0102	1	.01
BAR	14.51	1.02	100	1

1 psi x 6.895 = 6.895 kPa

Area

from \ to	cm^2	m^2	in^2	ft^2
cm^2	1	.0001	.1550	.00108
m^2	10,000	1	1550.0	10.76
in^2	6.452	.000645	1	.00694
ft^2	929.0	.0929	144.0	1

1.0 m^2 x 10.76 = 10.76 ft^2

Volume

from \ to	liter	m^3	ft^3	gallon
liter	1	.001	.03532	.2642
m^3	1000	1	35.31	264.2
ft^3	28.32	.02832	1	7.481
gallon	3.785	.00379	.1337	1

1 gallon x 3.785 = 3.785 liter

Flow Rate

from \ to	ml/min	Liter/min	GPM	m^3/hr
ml/min	1	.001	3785.0	.00006
Liter/min	1,000	1	3.785	.06
GPM	.000264	.2642	1	.2271
m^3/hr	16,667	16.67	4.403	1

1.0 m^3/hr x 4.403 = 4.403 GPM

Flux (Flow per area per time)

from \ to	GFD	LMH
GFD	1	1.7
LMH	.5882	1

1.0 GFD x 1.7 = 1.7 LMH

Flow Converted to Flux

from \ to	Series L GFD	Series L LMH	Series LP GFD	Series LP LMH	1450 sf Series i GFD	1450 sf Series i LMH
ml/min	.76	1.292	.023	.0391	3785.0	6434.5
Liter/min	760	1292	23	39.1	3.785	6.435
GPM	2876.6	4890.22	87.06	148	1	1.7
m^3/hr	12665	21531	383.3	651.6	4.403	7.485

1 Liter/min x 23 = 23 GFD on a Series LP Machine

Temperature

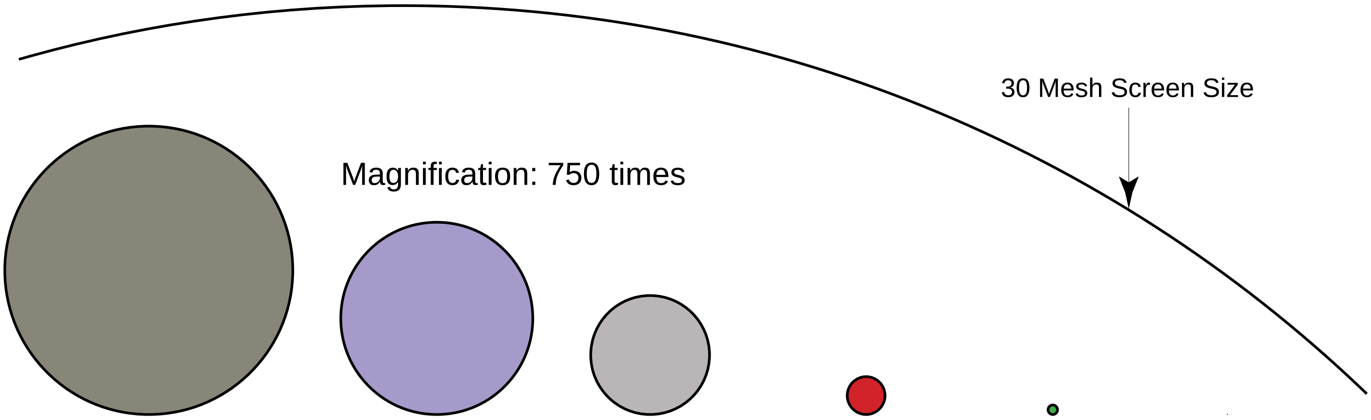
ºC	ºF	ºC	ºF	ºC	ºF
-200	-328	5	41	43	109
-180	-292	10	50	44	111
-160	-256	15	59	45	113
-140	-220	20	68	46	115
-120	-184	21	70	47	117
-100	-148	22	72	48	118
-95	-139	23	73	49	120
-90	-130	24	75	50	122
-85	-121	25	77	51	124
-80	-112	26	79	52	126
-75	-103	27	81	53	127
-70	-94	28	82	54	129
-65	-85	29	84	55	131
-60	-76	30	86	56	133
-55	-67	31	88	57	135
-50	-58	32	90	58	136
-45	-49	33	91	59	138
-40	-40	34	93	60	140
-35	-31	35	95	65	149
-30	-22	36	97	70	158
-25	-13	37	99	75	167
-20	-4	38	100	80	176
-15	5	39	102	90	194
-10	14	40	104	100	212
-5	23	41	106	120	248
0	32	42	108	140	284

128 fl oz = 1 Gallon
8 Pints = 1 Gallon
4 Quarts = 1 Gallon
1 fl oz = 28.3 grams
1 Kilogram = 2.2 Pounds
1 Pound = 16 oz
1 Gallon = 8 Pounds
1 Horsepower = 0.7457 Kilowatts
1 Inch = 25.4 mm
1 Inch = 2.54 cm

$$1\ \text{KW} = \frac{\text{Gal x ºF Temp Rise}}{\text{325 x Heat up time, hrs}}$$

Relative Particle Sizes:

1 Millimeter equals 1,000 Microns



Human Hair 60 Microns | Limit of Human Visibility 40 Microns | White Blood Cell 25 Microns | Red Blood Cell 8 Microns | Bacteria 2 Microns | Microfiltration 0.1 Microns

Inches	Microns	Mesh Size	Inches	Microns	Mesh Size
.0787	2000	10	.0035	88	170
.0661	1680	12	.0029	74	200
.0555	1410	14	.0026	65	
.0469	1190	16	.0024	62	230
.0394	1000	18	.0021	53	270
.0331	840	20	.0020	50	
.0280	710	25	.0017	44	325
.0232	590	30	.0016	40	
.0197	500	35	.00142	36	400
.0165	420	40	.00118	30	
.0138	350	45	.00099	25	550
.0117	297	50	.00079	20	625
.0098	250	60	.00059	15	
.0083	210	70	.000394	10	1250
.0070	177	80	.000315	8	1750
.0059	149	100	.000197	5	2500
.0049	125	120	.000099	2.5	5000
.0041	105	140	.0000394	1.0	12000

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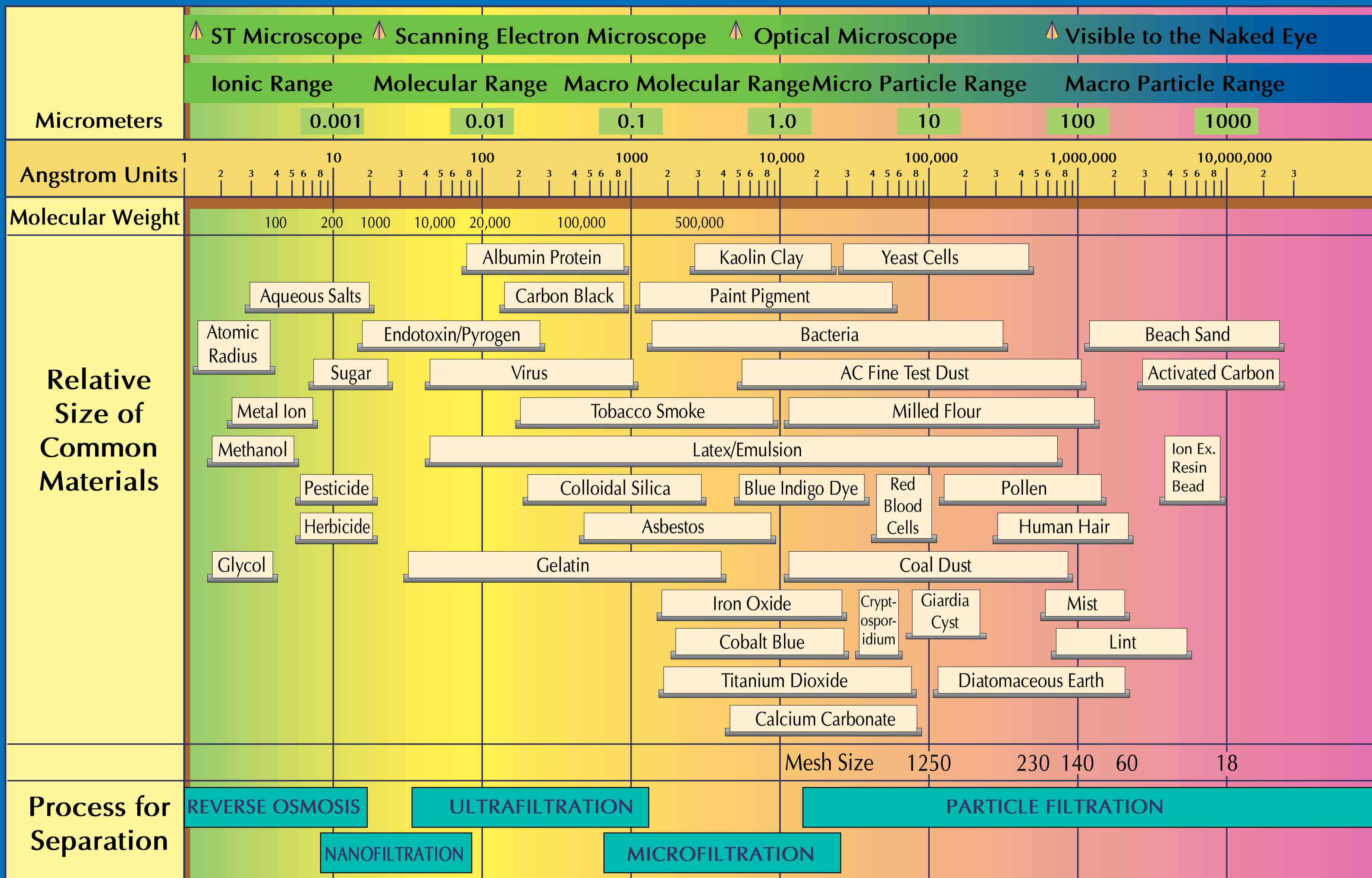
Pilot Test Handbook | Figure 26.1 | Ver 3.0 | 4/05/03

Relative Particle Sizes

New Logic Research, Inc. The Filtration Spectrum



1 Micron (1×10^{-6} Meters) = ~ 4×10^{-5} Inches (0.00004 Inches)
1 Angstrom Unit = 10^{-10} Meters = 10^{-4} Micrometers (Microns)

New Logic Reseach, Inc.
1295 67th St, Emeryville, CA 94608 USA
510-655-7305 (tel); 510-655-7307 (fax)
info@VSEP.com (e-mail); www.vsep.com

Flow Capacity Nomogram

Based on Formula:

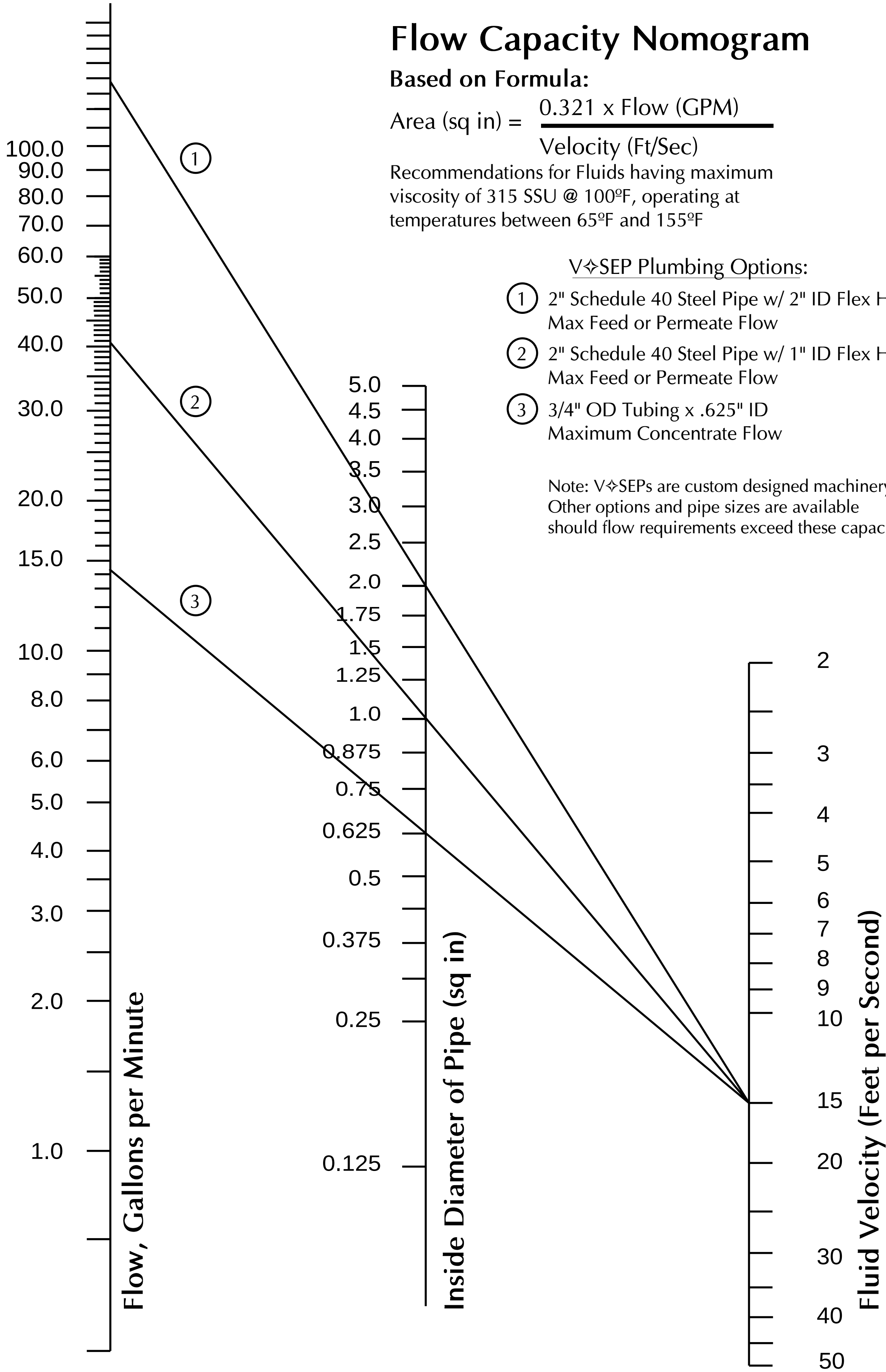
$$\text{Area (sq in)} = \frac{0.321 \times \text{Flow (GPM)}}{\text{Velocity (Ft/Sec)}}$$

Recommendations for Fluids having maximum viscosity of 315 SSU @ 100ºF, operating at temperatures between 65ºF and 155ºF

V✧SEP Plumbing Options:

1. 2" Schedule 40 Steel Pipe w/ 2" ID Flex Hose
   Max Feed or Permeate Flow
2. 2" Schedule 40 Steel Pipe w/ 1" ID Flex Hose
   Max Feed or Permeate Flow
3. 3/4" OD Tubing x .625" ID
   Maximum Concentrate Flow

Note: V✧SEPs are custom designed machinery
Other options and pipe sizes are available
should flow requirements exceed these capacities



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Pilot Test Handbook	Figure 26.3	Ver 3.0	4/05/03

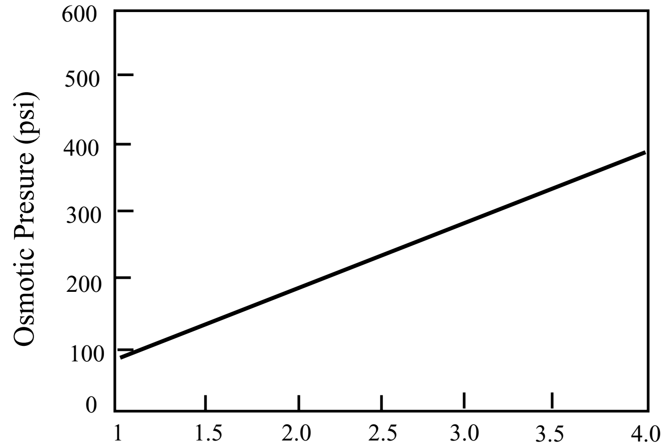
Flow Capacity Nomogram

Osmotic Pressure

Effects of Osmotic Pressure:
Osmotic Pressure can be defined as the amount of pressure above 1 atmosphere which can restore equilibrium between a solvent in solution and the pure solvent at one atmosphere. Osmotic pressure is a colligative property based upon the molarity of a solution. The colligative molarity of a solution is the molarity in moles per liter multiplied by the number of ions produced by a molecule when dissolved in a solvent.

Osmotic pressure creates a resistance to flux through a membrane. Essentially the osmotic pressure can be subtracted from the feed pressure in order to determine the actual transmembrane pressure. When the osmotic pressure is approximately 100 psi less than the feed pressure then there will be little or no flux of water through the membrane. If the osmotic pressure is high enough then water may be driven back through the membrane.

NaCl Solution

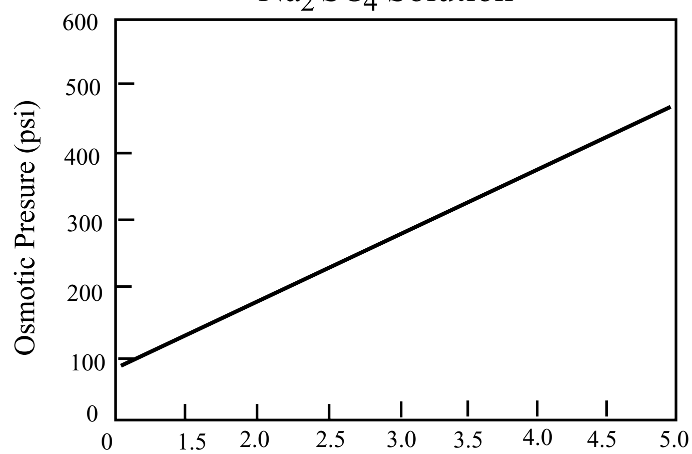


Calculating the Osmotic Pressure of a Solution:
The osmotic pressure of a solution for dilute solutions is similar to the Ideal Gas Law. The osmotic pressure is proportional to the temperature and the colligative molality of the solution.

$$\Pi = R\ T\ M_c$$

where
Π = Osmotic Pressure (atm.)
R = Gas Law Constant (lit. atm/mol. K)
T = Temperature (K)
M_c = Colligative Morality (Mol/lit.)

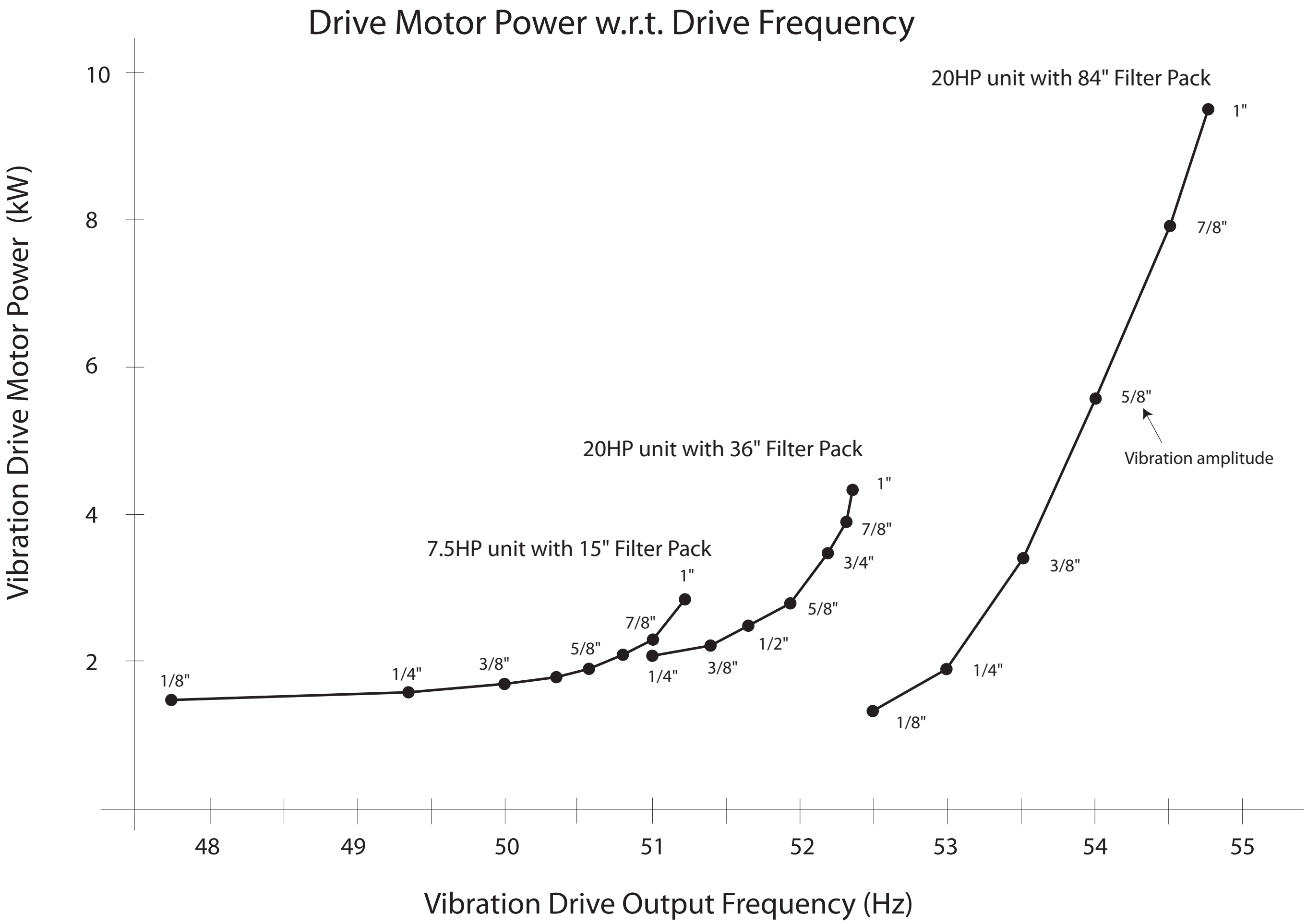
Na_2SO_4 Solution



Graphs of Osmotic Pressure:
To the right are two graphs of osmotic pressure versus concentration for two different components dissolved in water. They can be used to give you an idea of the maximum concentration that can be achieved based on the osmotic pressure of the solution and the maximum feed pressure of a membrane separations system.

Given that the current system design of V✧SEP has a maximum feed pressure of 1000 psi, the maximum concentration of rejected material for Sodium Sulfate solution would then be a little more than 10%.

Use the equation given above to calculate the osmotic pressure for other solutions using the molecular weight and number of ions formed from each molecule.



Method: Incrementally increased frequency output of drive
Recorded %Motor Load and Vibration Amplitude
Power = (%Load / 100) x (MotorHP) x .746kW/1HP

7.5HP Unit with 15" Filter Pack

Equipment: V✧SEP Series i # I-180 Process Feed: Water at 76 psi

Data: (47.77Hz,26.7%,1/8"), (49.32Hz,28.1%,1/4")(49.99Hz,30.2%,3/8")
(50.36,32.2,1/2"),(50.6Hz, 34.4%, 5/8"),(50.81Hz,37.4%,3/4")
(51.02Hz, 41.4%, 7/8"), (51.2Hz, 50%, 1")

20HP Unit with 3' Filter Pack

Equipment: V✧SEP Series i # I-188 Process Feed: Water at 64 PSI

Process Feed: Water at 55 psi

Data: (49.3Hz,13.3%,1/8"), (51.02Hz,14%,1/4")(51.4Hz,14.5%,3/8")
(51.67,16.5%,1/2"),(51.93Hz, 18.8%, 5/8"),(52.07Hz,23.2%,3/4")
(52.3Hz, 26%, 7/8"), (52.34Hz, 29%, 1")

20HP Unit with 7' Filter Pack

Equipment: V✧SEP Series i # I-186 Process Feed: Water at 55 PSI

Process Feed: Water at 55 psi

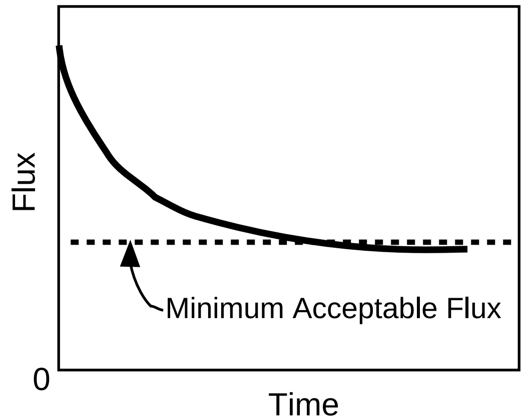
Data: (52Hz, 10%, 0"), (52.5Hz, 10.5%,1/8"), (53Hz, 13%, 1/4")
(53.5Hz, 18%, 3/8"), (54.0Hz, 32%, 5/8"), (54.5Hz, 53%, 7/8")
(54.7Hz, 65%, 1")

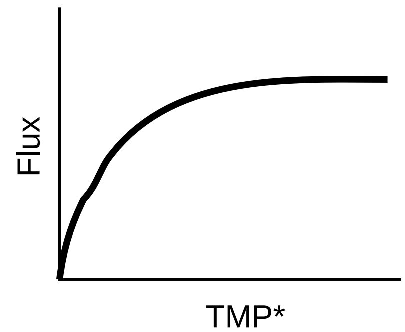
V✧SEP Basic Operation

Constant Feed Pressure

The two graphs at the right exhibit the attributes of a system that is operated with a constant feed pressure.

The graph on the left shows the flux decay that occurs with time. For this operation there will be a minimum acceptable operating flux that is based on the process flow rate. When the flux reaches the minimum level then the system is cleaned and the flux is recovered.

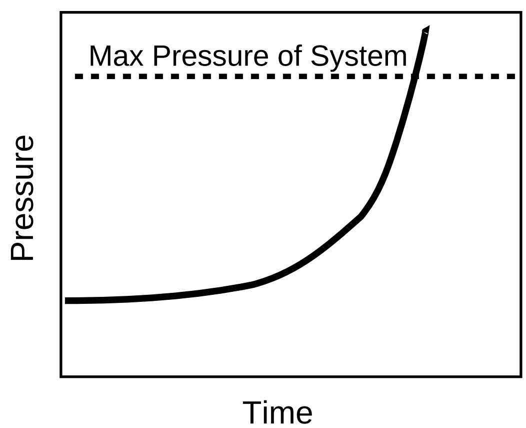


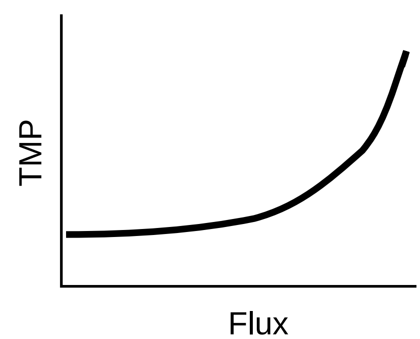


In the graph at the right, you can see the flux as it relates to the transmembrane pressure (TMP). As you can see from the graph, the flux increases as a result of increasing transmembrane pressure until a steady state is reached. This way of operating the system is the most simple and requires some measure of the flow rates in order to calculate the flux.

Constant Permeate Flow

The two graphs at the right show some of the operation characteristics for a system where the permeate flow rate is kept constant. The graph on the left shows the pressure as it relates to time. The pressure will increase with time in order to maintain the same flow rate. This is due to the fact that the flux will slowly decay as above. Instead of a minimum flux rate to indicate when the system needs to be cleaned the indicator is the maximum pressure that the system can withstand.



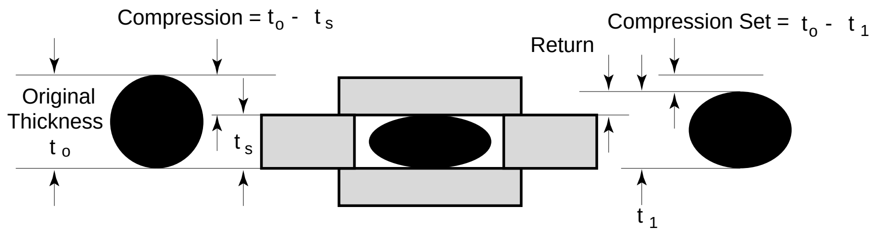


In the graph at the right, you can see the relationship between the transmembrane pressure (TMP) and the flux. In order to maintain a steady permeate flow to counter the flux decay, you will slowly increase the feed pressure with a motor speed controller. This system is a little more complex to control but produces the most consistent results especially where process flow rates are an important factor. The risk is that the pressure can be infinite and the system has a maximum pressure before the membranes and the machine are damaged.

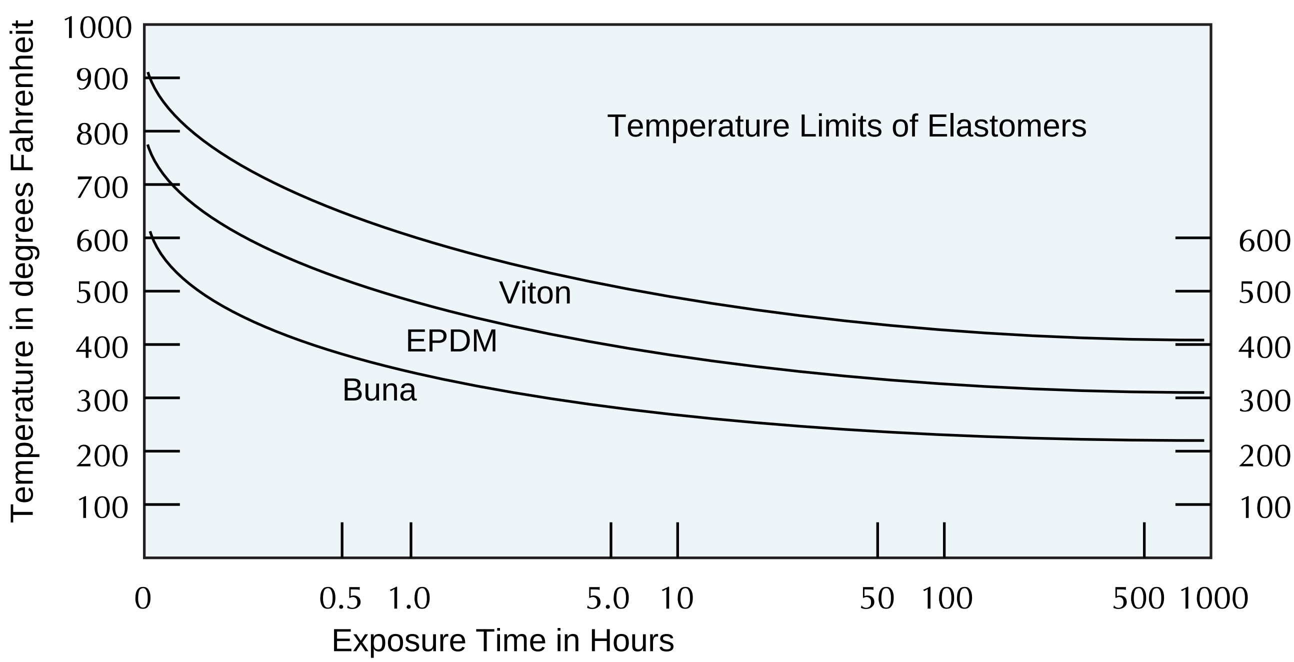
O-ring Seal Properties:

Various Elastomers Used:

EPDM: Ethylene propylene copolymer -65 ºF to +300ºF
Viton: Fluorocarbon Rubber -15 ºF to +400ºF
Buna: Copolymer of Butadiene and Acrylonitrite -65 ºF to +275ºF



Although it is desirable to have a low compression set, this is not as critical as it might appear. A good balance of all properties is usually necessary for optimum seal performance. For instance, a seal will continue to seal after taking a 100% compression set provided temperature and pressure remain steady. ASTM requires compression equal to 25% of t_o. In general V ✧SEP O-ring design includes face seal type glands and have a range of compressions between 20% and 30%.



Temperature limitations of elastomers are based on long term durability. As illustrated above short term or intermittent service at higher temperatures can be handled by these materials. Therefore, when the application requires higher temperature than that recommended, check the temperature curve to determine if the total accumulated time at high temperature is within the maximum allowable limit.

Temperature Limitations:

and thermal characteristics for
Series i Raw Materials used in construction

Location or Parts Used	Raw Material	Max Temp
Filter Pack End Plates	Polypropylene	180 ºF
Filter Pack End Plates	Teflon (PTFE)	500 ºF
Filter Pack End Plates	Kynar (PVDF)	285 ºF
Spring clamps, Bushings	Nylon (Cast 6)	230 ºF
Filter Pack Housing	Vinyl Ester FRP	200 ºF
O-rings & Seals	EPDM	300 ºF
O-rings & Seals	Viton (76)	410 ºF
O-rings & Seals	Buna (Nitrile)	275 ºF
Spring Node Rubbers	Polyurethane	190 ºF
Node Stabilizer Bumpers	Neoprene	170 ºF
Frame Plumbing Clamps	Polypropylene (copolymer)	212 ºF
Torsion Spring Clamps	Santoprene	302 ºF
Torsion Spring Clamps	Polyamide	350 ºF
Torsion Spring Clamps	Aluminum	750 ºF
Flexible Hose	1" Teflon	300 ºF
Flexible Hose	2" Teflon	300 ºF
Flexible Hose	2" Neoprene	212 ºF

Notes:

1] Other limitations exist as well, ie pressure, absorption, conductivity, creep, tensile strength, chemical resistance, etc.
2] Thermoplastics also have a melting point and will return to a liquid state.
3] Limits shown are for maximum continuous temperature of the media in contact
4] Mechanical properties such as pressure limits, tensile strength, coefficient of friction, etc are generally determined at room temperature (73ºF). As temperature increases the thermoplastic becomes more ductile, increases in impact strength, and decreases in tensile strength. Derating of materials may be necessary at higher temperatures
5] Thermoplastics melt before they burn when exposed to open flame, and generate toxic carbon monoxide, non-toxic carbon dioxide, water vapor, and dense smoke.
6] Plastic and rubber , unlike metal, is a very poor conductor of heat. Temperature related failure is likely to result at the point of contact with the media attached to it.

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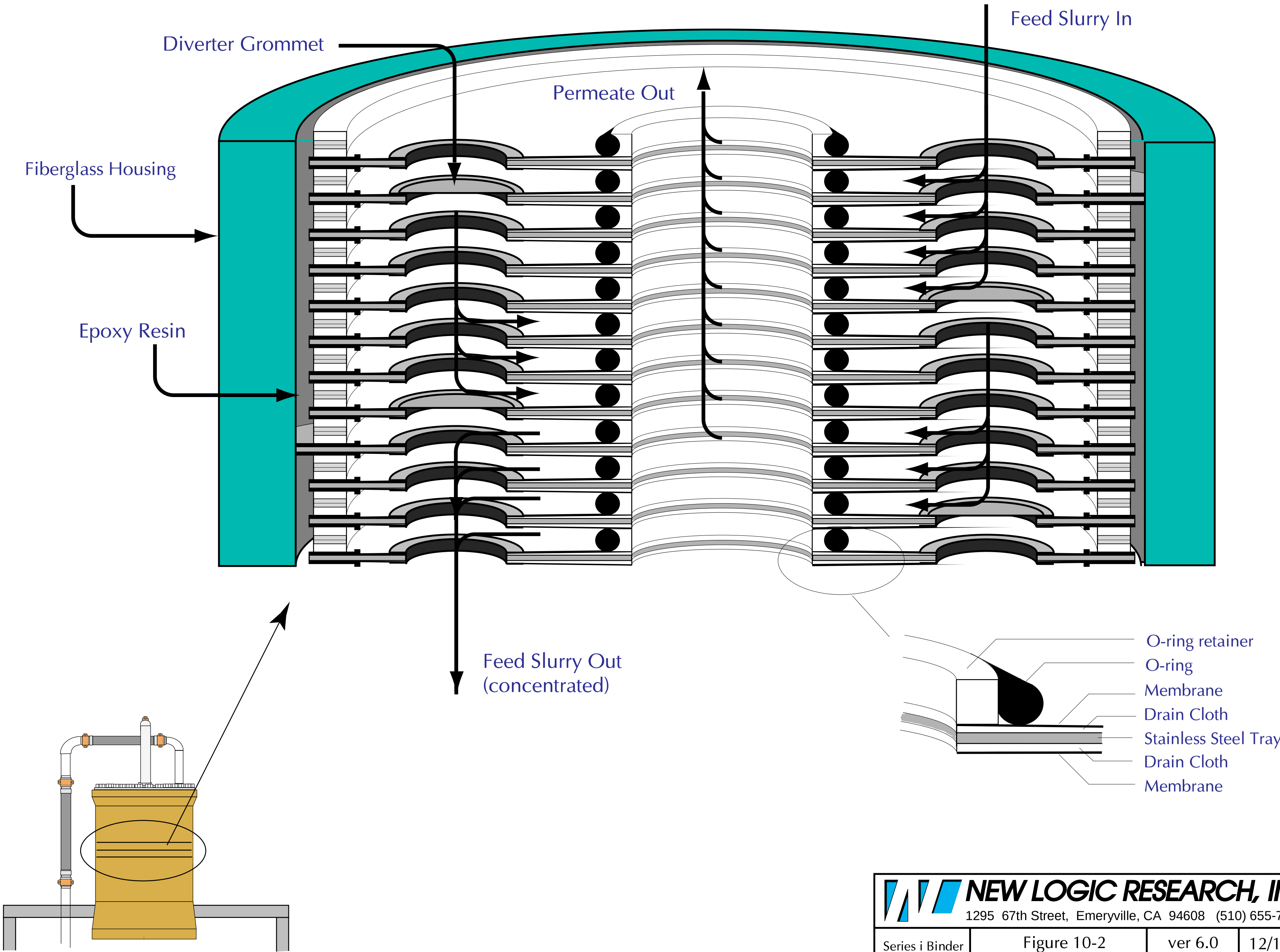

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Series i Binder	Figure 10-2	ver 6.0	12/15/02

Filter Pack Section Illustration

Viscosity Conversions:

for calculating pressure loss and flow limitations
of Series i Machines and pumps

Typical Liquids @ 70º F	SSU*	Centipoise
Water	31	0.8
Kerosene	35	2.05
No. 2 Fuel Oil	50	5.92
No. 4 Fuel Oil	80	12.6
Transformer Oil	100	16.2
Hydraulic Oil	200	34.6
SAE 10w Oil	300	52.2
SAE 10 Oil	500	88.0
SAE 20 Oil	1,000	173
SAE 30 Oil	2,000	352
SAE 50 Oil	5,000	880
SAE 60-70 Oil	10,000	1,760
Molasses B	50,000	8,800
Molasses C	100,000	17,300

Viscosity: The viscosity of a fluid is a measure of its tendency to resist shearing force. High viscosity fluids require a greater force to shear at a given rate than low viscosity

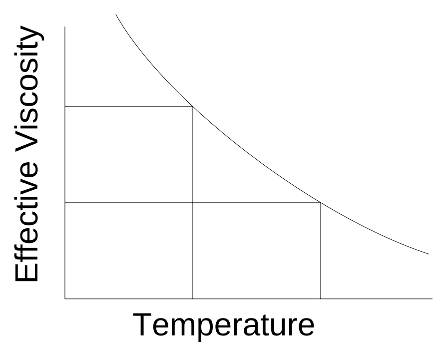
Centipoise: (cps) Measures absolute viscosity = 1/100th of a Poise

SSU: Staybolt Second Universal; measures the kinematic viscosity where the specific gravity of the fluid influences the viscosity measured

Conversion: SSU x .216 x Specific Gravity = Centipoise

Pumping Viscous Liquids:
Centrifugal pumps are generally not suitable for pumping viscous liquids. However, liquids with viscosities up to 2000 SSU can be handled with centrifugal pumps. The volume and pressure of the pump will be reduced according to the following table. Comparisons are made against water: 30 SSU

Viscosity SSU	30	100	250	500	750	1000	1500	2000
Flow Reduction % GPM	--	3	8	14	19	23	30	40
Head Reduction % Feet	--	2	5	11	14	18	23	30
Horsepower % Increase	--	10	20	30	50	65	85	100



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Pilot Test Handbook	Figure 27.1	ver 3.0	12/15/03

Viscosity Conversions for Series i Calculations

The Viscosity of Water: 0 C to 100 C

C	cp	C	cp	C	cp	C	cp
0	1.787	26	.8705	52	.5290	78	.3638
1	1.728	27	.8513	53	.5204	79	.3592
2	1.671	28	.8327	54	.5121	80	.3547
3	1.618	29	.8148	55	.5040	81	.3503
4	1.567	30	.7975	56	.4961	82	.3460
5	1.519	31	.7808	57	.4884	83	.3418
6	1.472	32	.7647	58	.4809	84	.3377
7	1.428	33	.7491	59	.4736	85	.3337
8	1.386	34	.7340	60	.4665	86	.3297
9	1.346	35	.7194	61	.4596	87	.3259
10	1.307	36	.7052	62	.4528	88	.3221
11	1.271	37	.6915	63	.4462	89	.3184
12	1.235	38	.6783	64	.4398	90	.3147
13	1.202	39	.6654	65	.4335	91	.3111
14	1.169	40	.6529	66	.4273	92	.3076
15	1.139	41	.6408	67	.4213	93	.3042
16	1.109	42	.6291	68	.4155	94	.3008
17	1.081	43	6178	69	.4098	95	.2975
18	1.053	44	.6067	70	.4042	96	.2942
19	1.027	45	.5960	71	.3987	97	.2911
20	1.002	46	.5856	72	.3934	98	.2879
21	0.9779	47	.5755	73	.3882	99	.2848
22	0.9548	48	.5656	74	.3831	100	.2818
23	0.9325	49	.5561	75	.3781		
24	0.9111	50	.5468	76	.3732		
25	0.8904	51	.5378	77	.3684		

Use the Correction Factors above to Temperature Correct Flux:

$$\text{Actual GFD Measured} \quad \times \frac{\text{Viscosity of water @ actual temperature}}{\text{Viscosity of water @ correction temperature}} = \text{Temperature Corrected GFD}$$

Example: 43 gfd was measured @ 18 C, Temperature Correct to 40 C

$$43 \text{ gfd} \quad \times \frac{1.053}{.6529} \quad = \quad 43 \text{ gfd} \quad \times \quad 1.6128 = \quad 69.4 \text{ TC GFD}$$

27.3 Conversion Factors & Formulas

Legend:

GFD = Gallons per square foot per day
LMH = Liters per square meter per hour
°C = Degrees Centigrre
SSU = Staybolt Second Universal
ID = Inside Diameter
FPM = Feet per Minute
# Trays = Number of membrane trays in FRP

fps = Feet per second
RPM = Rotations per minute
SSU = Staybolt Second Univerade
°F = Degrees Fahrenheit
GPM = Gallons per minute
SF = Square feet of membrane

For converting GFD (Gallons per square foot per day) to LMH (Litres per square meter)

GFD x 1.72 = LMH

For converting Gallons per minute (GPM) to LPH (Litres per hour)

GPM x 227.1 = LPH

For converting Gallons per minute (GPM) for a certain size Filter Pack to GFD(Gallons per square foot per day)

GPM x 1440 ÷ SF of filter pack = GFD

For determining the square footage of a Filter Pack (3.058sf = membrane area of one tray)

#Trays x 3.058 = SF

For converting degrees Celsius to Fahrenheit & visa versa

$°C = 5/9\ (°F - 32)$ $°F = 9/5\ C + 32$

For converting SSU to Centipoise (Measures of Viscosity)

SSU x .216 x Specific Gravity = Centipoise

For determining pipe size required for specific flow rates (GPM) and fluid velocity (FPS)

Pipe ID Required (sq in) = 0.321 x Flow(gpm) /Velocity (fps)

For determining the speed of travel of the outer casing of the eccentric bearing

Surface Speed (fpm) = Shaft Diameter x RPM x 0.26227.

For determining solids concentrations

%Solids = (Grams Solute/Grams Solution) x100

Foot Pounds x 12 = Inch Pounds
Inch Pounds x 0.082 = Foot Pounds
Inches x 2.54 = Centimeters
1 Gal water = 2786 grams @ 50°F
1 Gal water = 3.785 Liters
1 Liter = .2642 Gallons

p = 3.14159
Series L Membrane = 0.478 SF
Series LP Tray = .865/ea
Series i Tray = 3.058/ea
Specific Gravity of Water = 62.4 lbs

V✧SEP Performance Calculations

Concentration Factor:

Concentration Factor = Feed Flow Rate / Concentrate Flow Rate
Feed Flow Rate = Permeate Flow Rate + Concentrate Flow Rate

Example: Your Permeate Flow Rate is 2179ml/min
Your Concentrate Flow Rate is 179 ml/min

Feed Flow Rate = 2179 ml/min + 179 ml/min
Feed Flow Rate = 2358 ml/min

Concentration Factor = 2358 ml/min / 179 ml/min
Concentration Factor = 13.2x

Concentrate Flow Rate: (while using the timed duty cycle valve)

Concentrate Flow Rate per Minute = Concentrate Rate per dump / (Time Open + Time Closed)

Example: 430 ml of concentrate is released each time the valve opens
Your Auto Valve settings are 0.5 minutes open and 3.0 minutes closed

Concentrate Flow Rate = 430 ml / (0.5 + 3.0)
Concentrate Flow Rate = 430 ml / 3.5
Concentrate Flow Rate = 123 ml/min

% Recovery: (Permeate)

% Recovery = Permeate Flow Rate / Feed Flow Rate x 100
Feed Flow Rate = Permeate Flow Rate + Concentrate Flow Rate

Example: Your Permeate Flow Rate is 2179ml/min
Your Concentrate Flow Rate is 179 ml/min

Feed Flow Rate = 2179 ml/min + 179 ml/min = 2358 ml/min
% Recovery = 2179 ml/min / 2358 ml/min x 100
% Recovery = 92.4%

GFD in P Mode: (Gallons per Square Foot of Membrane per Day)

Example:
2000 ml/min x .0002642 Gal/ml = .528 Gallons/min
.528 Gal/min x 1440 min/Day = 761 Gal per Day
761 GPD / 16.69 SF/Filter Pack = 45.596 GFD

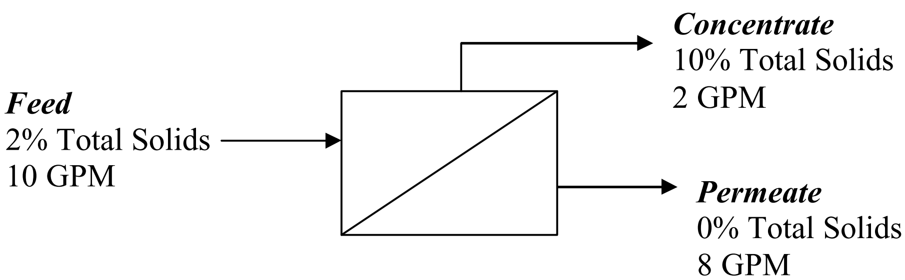
2000 ml/min x .0228 = GFD

Permeate Rate x .0228 = GFD

GFD in L Mode: (Gallons per Square Foot of Membrane per Day)

Permeate Rate x .76 = GFD

Concentration Factor related to % Recovery



When there are virtually no solids in the permeate then that calculations of concentration factor and recovery can be easily related. In the above example you calculate % recovery (permeate) by dividing the permeate flow rate or amount of permeate by the feed flow rate or amount of feed.

8/10 = 0.8 = 80% permeate recovery

The concentration factor can be calculated by dividing the final solids by the initial solids.

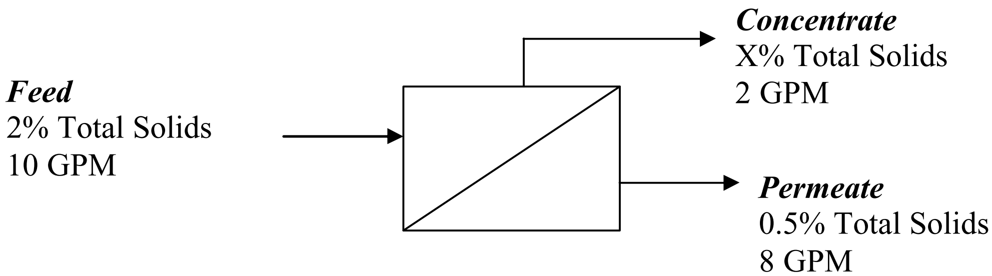
10/2 = 5x concentration of solids

These two are related by the following equation:

Concentration Factor (CF) = 1/(1-%Recovery) = 1/(1-0.8) = 5

You can do a similar calculation for 90% recovery and should do it for practice. What you will find by doing the calculations is summarized in the following table.

% Recovery	CF
50	2X
60	2.5X
70	3.33X
75	4X
80	5X
85	6.67X
90	10X
95	20X
98	50X



When there are solids in the permeate then that calculations of concentration factor and recovery might be a little more difficult. In the above example you are given the solids in the feed and the solids in the permeate but lets assume that a hose broke on the machine and so you had no concentrated material to test % solids. You can calculate this using a material balance. A material balance basically indicates that whatever goes in must come out.

The first thing you do is determine the total flow of solids by multiplying the % solids by the flow.

10 x 2 = 20 in the feed (no real units here)

Then you want to set that equal to what you know comes out so:

20 = (Total in Concentrate) + (Total in Permeate)
20 = (2X) + (8x0.5) = 2X + 4

Solving for X you get:

16 = 2X or X = 8

Therefore the amount of solids in the concentrate is 8%. The concentration factor would be 8/2 = 4x. But note that the recovery in this case is still 80% even though the concentration factor is lower.

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TECHNICAL INFORMATION

Corrosion Data

The information presented in this data chart is intended as a guide to the chemical resistance to materials used in the manufacture of SVF valves.

Many factors which will influence corrosion rating such as - temperature fluctuations, concentrations and aeration of fluids, high velocity or abrasions in the fluid steam, etc. have to be taken into account. The physical properties of material are affected differently by each corrosive media and is sometimes necessary to sacrifice valves in one property to gain a maximum valve in another property.

An "A" rating should be given to internal moving parts, in direct contact with the media. In some cases a "B" rating can be given to body material in direct contact with media, when the corrosion rate is not one to cause any serious problems.

Ratings Explanation

A = Excellent / B = Good / C = Poor / D = Do not use

Blank = No information available.

Ratings are based on media at room temperatures = unless otherwise specified.

We would advise that ratings given to be used as a guide to the selection or valve materials and not as an absolute recommendation.

Although most of the suggested ratings in this corrosion chart are based on experience, SVF cannot accept responsibility for problems arising from use of this data.

We do however recommend that in critical applications, tests be conducted to verify the rating.

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Acetaldehyde	B	C	C	C	A		A	A	A	D	A	B	C		A
Acetamide	B	B	B	B	B					A	A				A
Acetate Solvents	A	B	A	B	A			A	A	D	D		D		A
Acetic Acid, aerated	B	D	D	D	A			A	A	C	D		C	A	A
Acetic Acid, Air Free	B	B	D	D	A	A	A	A	A	C	D		D	A	A
Acetic Acid, crude	C	C	C	C	A	A	A	B	A	D	D		D	A	A
Acetic Acid, glacial						A			A	D		B	C	A	A
Acetic Acid, pure	C	C	D	D	A	A	A	D	A	D	D		D	A	A
Acetic Acid, 10%	C	C	C	C	A	A	A	B	A	D	B	B	D	A	A
Acetic Acid, 80%	C	C	C	C	A	A	A	B	A	D	D	C	D	A	A
Acetic Acid Vapors	B	D			D	D	B	C	A	D				A	A
Acetic Anhydride	B	D	D	D	B	B	B	B	A	D	C	C	D	A	A
Acetone	A	A	A	A	A	A	A	A	A	D	A	A	D	A	A
Other Ketones	A	A	A	A	A	A	A	A	A	D	A	D	D		A
Acetyl Chloride	D	A		D	C			B	A	D	D	D	D		A
Acetylene	A	B	A	A	A	A	A	A	A	B	A	A	A		A
Acid Fumes	B	D	D	D	B		B			C	D				A
Acrylonite	B	A	A	C	A		B	A	A	D	D	D	C		A
Air	A	A	A	A	A		A	A	A	A	A	A	A		A
Alcohol, Amyl	B	B	B	C	A		B	B	B	C	A	A	B	A	A
Alcohol, Butyl	B	B	B	C	A		A	A	A	B	A	C	A	A	A
Alcohol, Diacetone	A	A	A	A	A		A	B	A	D	A	B	D	A	A
Alcohol, Ethyl	B	B	B	B	B		A	B	A	A	A	A	A	A	A
Alcohol, Fatty	B	B	B	B	A		A		A	B	A	A		A	A
Alcohol, Isopropyl	B	B	B	B	B		A	B	B	C	A	A	A	A	A
Alcohol, Methyl	B	B	B	B	A		A	A	A	B	A	A	C	A	A
Alcohol, Propyl	A	A	B	B	A		A	A	A	B	A	A	A	A	A
Alumina	A	A							A	A	A	A			A
Aluminum Acetate	C	D		D	A	B	B	C	B	D	D	A	D		A
Aluminum Chloride dry	B	B	C	D	C		D	B	B	B	A	A	A	A	A
Aluminum Chloride Solution	C				D	C	B	B	A	B	D		A	A	A
Aluminum Fluoride	C		D	D	C			B	A	A	C	A	A		A
Aluminum Hydroxide	A	A	D	D	A	B	B	B	B	A	C	A	A		A
Aluminum Nitrate	D	D		D	C		B	C	B	B	D	B	D		A
Aluminum Oxalate	B						A	B	A						A
Alum (Aluminum Potassium Sulfate)	D	D		D	B	C	B	C	A	B	D		B	A	A
Alum (Aluminum Sulfate)	C	C	D	D	B	A	B	C	A	A	D	A	A	A	A
Amines	B	B	B	C	A	A	A	B	B	D	C	C	D		A
Ammonia, Alum	C				A		A		A	B	C			A	A
Ammonia, Anhydrous Liquid	A	D	A	B	A	A	A	B	A	B	D	B	D	A	A
Ammonia, Aqueous	B	D	A	A	A		A	B	B	B	D		A	A	A
Ammonia, Gas, hot	A	D		B	A		A	B	B	C	D	A	D	A	A
Ammonia Liquor					A		A		B					A	A
Ammonia Solutions	C	D	B	B	A		A	B	B	B	D	B	D	A	A
Ammonium Acetate	B	D		B	B		A	B	B	B	D	A	D		A
Ammonium Bicarbonate	B	B	C	B	B		B	B		B	A	A	A		A
Ammonium Bromide 5%	D				B		B	B			A				A
Ammonium Carbonate	B	B	B	B	B		B	B		C	D	A	B		A
Ammonium Chloride	D	D	D	D	C	C	B	B	B	B	C	A	A		A
Ammonium Hydroxide 28%	C	D	C	C	B	A	A	D	B	B	D	B	A	A	A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Ammonium Hydroxide Concentrated	C	D	C	C	B	A	A	C	B	C	D	A	A	A	A
Ammonium Monosulfate	D				A		B	B	B		D				A
Ammonium Nitrate	B	D	D	D	A	A	B	D	B	A	D	A	A		A
Ammonium Oxalate 5%	A				A		A	B			A				A
Ammonium Persulfate	C	C			A		A	D		D	D	B	B		A
Ammonium Phosphate	C	D	D	D	B		B	C		A	C	A	A		A
Ammonium Phosphate Di-basic	B	C	D	D	B		B	C	B	A	A		A		A
Ammonium Phosphate Tri-basic	C	C	D	D	B		B	C	B	A	A		A		A
Ammonium Sulfate	C	C	C	D	B	B	B	B	B	A	B	A	B	A	A
Ammonium Sulfide	C	D	D	D	B		B	B		A	A	A	D		A
Ammonium Sulfite	C	C	C	C	A		B	D		B	A	B	A		A
Amyl Acetate	B	B	C	C	B	A	A	B	A	D	A	B	D		A
Amyl Chloride	D	B		B	A		A	B	B	D	A	D	D		A
Aniline	C	D	C	C	B		A	B	B	D	D	C	C	A	A
Aniline Dyes	C	C	C	C	A		A	A		C	A	C	B		A
Apple Juice	B	C	D	D	B		A	A		A	A	B	A		A
Aqua Regia (Strong Acid)	D	D	D	D	B		B			D	D	D	D	D	A
Aromatic Solvents	A	A	C	B	A		A	B		D	A	D			A
Arsenic Acid	D	D	D	D	B		B	D	B	A	D	B	A	A	A
Asphalt Emulsion	C	A	B	B	A		A	A	A	D	A	D	A		A
Asphalt Liquid	C	A	B	B	A		A	A	A	C	A	D	A		A
Barium Carbonate	C	B	B	B	B		B	B	A	B	A	A	A		A
Barium Chloride	D	B	C	C	B	B	C	B		A	A	A	A		A
Barium Cyanide	D	C		C	B		B	D		B	A	B	B		A
Barium Hydrate	D	D			A		A	B			A				A
Barium Hydroxide	D	C	C	B	B	A	A	B		A	A	B	A		A
Barium Nitrate	B				A		A				A				A
Barium Sulfate	D	C	C	C	A		A	B		A	A	B	A		A
Barium Sulfide	D	D	C	D	B		B	C		A	A	A	A		A
Beer	A	B	D	D	A	A	A	A		B	A	B	A		A
Beet Sugar Liquors	A	A	B	B	A		A	A		A	A	B	A		A
Benzaldehyde	A	A	A	C	A		A	B	B	D	A	A	D		A
Benzene (Benzol)	B	B	B	B	B	B	A	A	B	D	C	D	B	A	A
Benzoic Acid	B	B	D	D	B	A	B	B	A	C	A	D	B		A
Beryllium Sulfate	B	B		B	B		A	B		B	A	B	B		A
Bleaching Powder wet		B			C		B	D	A	D	D	B	B		A
Blood (Meat Juices)	B	B		D	A	A	A	B		B	A	B	B		A
Borax (Sodium Borate)	C	D	C	C	A			A	A	B	A	A	A		A
Bordeaux Mixture					A		A				A				A
Borax Liquors	C	A	C	C	B		A	A	B		A	A	A		A
Borax Acid	B	C	D	D	B		B	B	A	B	A	B	A	A	A
Brake Fluid	B	B		B	B	A		B		D	B	B	D		A
Brines, saturated	C	B	D	C	B		B	B	A	A	A	A	A		A
Bromine, dry	C	B	D	D	D		B	A	A	D	D	D	B	B	A
Bunker Oils (Fuel)	A	B	B	B	A		A	A		B	A		A		A
Butadiene	B	C	B	B	A		A	C	B	C	A	C	B		D
Butane	A	A	B	B	A		A	B	A	B	A	D	A		A
Butter					A		A			B	A				A
Buttermilk	A	D	D	D	A		A	D		A	A	B	A		A
Butyl Acetate	B	B		B	B		A	B	B	D	B	D	D		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Butylene	A	A	A	A	A		A	A		D	A	D	D		A
Butyric Acid	B	C	D	D	B		B	B	A	C	A	C	C		A
Calcium Bisulfate	C	C	D	D	B		B	D	B	A	D	D	A		A
Calcium Carbonate	C	C	D	D	B		B	B	B	A	A	B	A		A
Calcium Chlorate	B	D		C	B		B	B		B	D	B	B	B	A
Calcium Chloride	C	B	C	C	B	B	B	B	A	A	A	B	A		A
Calcium Hydroxide	D	C	C	C	B		B	A	A	A	A	A	A		A
Calcium Nitrate	B				B		B			B	C	B			A
Calcium Phosphate	D	C		C	B		B			B	B	B	B		A
Calcium Silicate	D	C		C	B		B			B	A	B	B		A
Calcium Sulfate	B	C	C	C	B	B	B	B	B	A	A	B	A		A
Caliche Liquor			B		A		A			B	A	A			A
Camphor	C	C		C	B		C	C		B	A	A	B		A
Cane Sugar Liquors	A	B		B	A		A	B		B	A	D	B		A
Carbonated Beverages	B	B	D	B	B	B	B	C		B	A	B	B	A	A
Carbonated Water	A	B	B	A	A	B	A	B		A	A	A	A	A	A
Carbon Bisulfide	A	C	B	B	B		B	B		D	A	D	A		A
Carbon Dioxide, Dry	A	A	A	B	A	A	A	A		C	A	B	B	A	A
Carbonic Acid	A	D	D	D	B	B	A	B		B	A	B	A	A	A
Carbon Monoxide	A	A		B	A	A	A	A	A	B	A	B	B		A
Carbon Tetrachloride, dry	B	C	B	C	A	A	A	A	A	D	A	D	B	A	A
Carbon Tetrachloride, wet		D	D	D	B		B	B	B	D	B	D	B	A	A
Casein	C	C		C	B		B	C		B	A	B	B		A
Caster Oil	A	A	B	B	A		A	A	A	A	A	B	A		A
Caustic Potash					A		A	B		B	D				A
Caustic Soda	D		B	B	A		A	A		C	D	B	B		A
Cellulose Acetate	B	B		B	B			B	B	D	C	B	D		A
China Wood Oil (Tung)	A	C	C	C	A		A	A	A	A	A	D	A		A
Chlorinated Solvents	D	C	C	C	A		A	B		D	A	D	C		A
Chlorinated Water	C				C	D	A	D	D	B	D		A	B	A
Chlorine Gas, dry	B	C	B	B	B	C	A	A	A	C	D	D	B	A	A
Chlorobenzene, dry	B	B	B	B	A		A	B	B	D	B	D	A		A
Chloroform, dry	D	B	B	C	A	B	A	A	B	D	A	D	B		A
Chlorophyll, dry	B	B		B	B		A	B		B		B	B		A
Chlorosulfonic Acid, dry	B	C	B	B	B		B	B	A	D	D	D	D		A
Chrome Alum	C	C	B	C	A		A	B		B	B	B	B		A
Chromic Acid < 50%	C	D	D	D	C	C	B	C	B	D	D	C	C		A
Chromic Acid > 50%	D	D	D	C	C	D	B	D	B	D	D	C	C		A
Chromium Sulfate	B	C		D	B		C	B		B	C	B	B		A
Cider	B				A		B	A			A				A
Citric Acid	B	C	D	D	B	C	A	B	A	B	A	B	A	A	A
Citric Juices	C	B	D	D	B		A	A		A	A		A		A
Coca-Cola Syrup					A		A			B	A		B		A
Coconut Oil	B	B	C	C	B		A	B		A	A	A	A		A
Coffee	A	A		D	A		A	B		A	A	A	A		A
Coffee Extracts, hot	A	B	C	C	A		A	A			A				A
Coke Oven Gas	A	C	B	B	A		A	B		C	D	D	B	A	
Cooking Oil	B	B	B	B	A		A	A		A	A	D	A		A
Copper Acetate	D	D	D	D	A		A	C	B	C	D	B	D		A
Copper Carbonate	D				A		A				A				A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Copper Cyanide	D	D		D	A		A	C		A	A	B	B		A
Copper Nitrate	D	D	D	D	B		B	D		A	A	B	A		A
Copper Sulfate	D	D	D	D	B	B	B	C	A	A	A	A	A	A	A
Corn Oil	B	B	C	C	B		B	B		A	A	C	A		A
Cottonseed Oil	B	B	C	C	B		B	B		A	A	C	B		A
Cresol					B		B			D	D	D	D		A
Creosote Oil	B	B	B	B	B	B	A	B	B	C	D	D	A		A
Cresylic Acid	C	C	C	D	B		B	B		D	D	D	B		A
Crude Oil, sour	B	C	B	C	A		A	B		A	A	D	A		A
Crude Oil, sweet	A	B	B	B	A		A	A		A	A		A		A
Cupric Nitrate	D				A		A	D			D				A
Cutting Oils, Water Emulsions	A	A	B	B	A		A			A	A		A		A
Cyanide Plating Solution	D	D		D	B		B	D		B	D	B	B		A
Cyclohexane	A	A	A	A	A		A	B	B	C	A	D	A		A
Cyclohexanone	B	B			A		A	B	B	D	A				A
Detergents, synthetic	B	B		B	B		A	B		B	A	B	A		A
Dextrin	B	B		B	B		B	B		B	A	B	B		A
Dichloroethane				C	C		B	B		D	D	D			A
Dichloroethyl Ether	B	B		B	B		B			D	D	D	D		A
Diesel Oil Fuels	A	A	A	A	A		A	A		A	A	D	A		A
Diethylamine	B	B	A	B	A		A	B		B	A	C	D		A
Diethyl Benzene					B		B			D	C	D			A
Diethylene Glycol	B	B		A	A		A	B		A	A	A	B		A
Diethyl Sulfate	B	B		B	B		B	B		C	A	C	B		A
Dimethyl Formamide	B	B		B	A		A	B		B	A	D	D		A
Dimethyl Phthalate										B	C		D		A
Dioxane	B	B		B	B		B	B		D	C	C	D	A	A
Dipentane (Pinene)	A	A		A	A		A			B	A	D	B		A
Disodium Phosphate	B				B		B	C		B	A		B		A
Dowtherm	A	A	B	B	A		A	A		D	A	D	A	A	A
Drilling Mud	B	B	B	B	A		A	B		A	A	A	A		A
Dry Cleaning Fluids	A	C	B	B	A		A	B		D	A		B		A
Drying Oil	C	C	C	B	B		B	B		A	A				A
Enamel		A								B	A	D			A
Epsom Salts ($MgSo_4$)	A	B	C	C	B		B	B		A	A		A		A
Ethane	A	B	C	C	B		B	B		A	A	D	A		A
Ethers	A	B	A	B	A	B	A	B		D	C	C	C		A
Ethyl Acetate	A	C	B	C	B	A	B	B	B	D	C	C	D		A
Ethyl Acrylate	C	B	C	C	A		A	B	A	D	B	C	D		A
Ethyl Benzene							A		A	C	A	D			A
Ethyl Bromide	B	A		B	B		C	B		B	A	B	B		A
Ethyl Chloride, dry	B	B	B	B	A	A	A	B	B	C	A	C	B		A
Ethyl Chloride, wet	D	C	D	D	B		B	B	B	C	A	B	B		A
Ethylene Chloride	C				A		A	B	B	D	A		D		A
Ethylene Dichloride					B		A	B		D	C	D	D	A	A
Ethylene Glycol	A	B	B	B	B	A	A	B	A	A	A	A	A		A
Ethylene Oxide	C	C	B	B	B		B	B	A	D	A	D	D		A
Ethyl Ether	B	B		C	A		A	A	B	D	A	D	D		A
Ethyl Silicate	A	B		B	B		B	B		B	A	B	B		A
Ethyl Sulfate					B		B			B	A	C	A		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Fatty Acids	B	C	D	D	A		A	B	A	B	A	D	A	A	A
Ferric Hydroxide					A		A	A		B	A				A
Ferric Nitrate	D	D	D	D	C	B	A	D	B	A	A	A	A		A
Ferric Sulfate	D	D	D	D	B	B	A	D		A	A	A	A		A
Ferrous Ammonium Citrate	B				B		B				A				A
Ferrous Chloride	D	B	D	D	D		D	D	D	A	A	A	A	A	A
Ferrous Sulfate	C	B	D	D	B		B	B	B	A	A	A	A	A	A
Ferrous Sulfate, Saturated	C	C	C	C	A		A	B	B	C	A	B	B		A
Fertilizer Solutions	B	C	B	B	B		B	B		B					A
Fish Oils	C	B	B	B	A		A	A		A	A	D	A		A
Flue Gases	C	B		B	A		A	B		C	C	D	C		A
Fluoboric Acid	B				B		A			A	D				A
Fluorosilicic Acid	D	B	D	D	B		B	A	B	C	C	C	C		A
Formaldehyde, cold	A	A	A	B	A	A	A	A	B	B	A	B	D		A
Formaldehyde, hot	B	B	D	D	C		B	B	B	B	A				A
Formic Acid, cold	D	B	D	D	B	B	A	B	A	D	D		B	A	A
Formic Acid, hot	D	B	D	D	B	D	B	B	B	D	D		A	A	A
Freon Gas, dry	B	B	B	B	A	A	A	A	B	C	A	C	C	A	A
Freon 11, MF, 112, BF	B	B		C	A		A	B	B	C	A	C	D	A	
Freon 12, 13, 32, 114, 115	A	A		B	A		A	B	B	B	A	A	D	A	
Freon 21, 31	B	B		C	A		A	B	B	D	A	D	D	A	
Freon 22	A	A		B			A		B	D	A	D	D	A	
Freon 113, TF	B	B		C	A		A	B	B	B	A	C	C	A	
Freon, wet	D	D		D	C	B	B	B	B	B	A	B	D	A	A
Fruit Juices	B	B	D	D	A		A	B		A	A	A	A		A
Fuel Oil	A	B	B	B	A		A	B		A	A	D	A		A
Fumaric Acid							A			B	A				A
Furfural	A	A	A	B	A	B	A	B	B	D	A	C	D		A
Gallic Acid 5%	A	C	D	D	B		B	B	B	B	A	C	A		A
Gas, Manufactured	B	B	B	B	B		B	A		A	A		A		A
Gas, Natural	B	B	B	B	A		B	A		A	A	D	A		A
Gas, Odorizers	A	A	B	B	B		A	B		B	A		A		A
Gasoline, Aviation	A	A	A	B	A		A	A	A	C	A		A	A	A
Gasoline, Leaded	A	A	A	A	A		A	B	A	C	A		A	A	A
Gasoline, Motor	A	A	A	B		A	A	A	A	C	A	D	A	A	A
Gasoline, Refined	A	B	B	B	A		A	B	A	C	A	D	A	A	A
Gasoline, Sour	A	B	B	B	A		A	C	A	C	A	D	A	A	A
Gasoline, Unleaded	A	A	A	B	A		A	A	A	C	A		A	A	A
Gelatin	A	A	D	D	A		A	B		A	A	A	A		A
Glucose	A	A	B	B	A		A	A	A	A	A	A	A		A
Glue	A	B	A	B	B		A	B	A	A	A	B	A		A
Glycerine (Glycerol)	A	B	C	B	A	A	A	A	A	C	A	A	B	A	
Glycol Amine	C	D		B	B	A			D	A	C	D	D	A	
Glycol	A	B	C	B	B		A	B		B	C	A	A		A
Graphite	B	B		C	B		A	B		B	A	B	B		A
Grease	B	C	A	A	A		A	B		A	A	D	A		A
Helium Gas	B	B		B	A		A	B	A	B	A	B	B		A
Heptane	A	A	B	B	A		A	B	A	A	A	D	A		A
Hexane	A	B	B	B	A		A	B	A	A	A	D	A		A
Hexanol, Tertiary	A	A	A	A	A		A	A	A	A	A	D	B		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Hydraulic Oil, Petroleum Base	A	B	A	B	A		A	A		A	A	D	A		A
Hydrazine	C	D		D	B		B	A		C	D	B	D		A
Hydrocyanic Acid	A	D	D	C	A		A	D	B	B	D	B	A		A
Hydrofluosilicic Acid	D	A	D	D	C		B	D		B	A	B	A	A	A
Hydrogen Gas, cold	A	B	B	B	A		A			B	A	B	A		A
Hydrogen Gas, hot	C		B		B		A		A	B	A	B			A
Hydrogen Peroxide, Concentrated	A	D	D	D	B		B	D	D	D	D	B	B		A
Hydrogen Peroxide, Dilute	A	C	D	D	B		B	D	D	A	D	B	A		A
Hydrogen Sulfide, Dry	A	C	B	B	A	B	B	B	B	C	C	A	A	A	A
Hydrogen Sulfide, Wet	B	D	C	D	B		B	C	D	C	C	B	A	A	A
Hypo (Sodium Thiosulfate)	B	C	D	C	B		B	B		A	A	A	A		A
Illuminating Gas	A	A	A	A	A		A	A		C	A	D	A		A
Ink-Newsprint	C	C	D	D	A		A	B		A	A	B	A		A
Iodoform	C	C	B	C	A		A	C			A		A		A
Iso-Butane					B		B			B	A	D			A
Iso-Octane	A	A	A	B	A		A	A		A	A	D	A		A
Isopropyl Acetate					B		A			D	A	D		A	A
Isopropyl Ether	B	A	A	B	A		A	B	A	C	A	D	D	A	A
J P-4 Fuel	A	A	A	B	A		A	A	A	A	A		A		A
J P-5 Fuel	A	A	A	A	A		A	A	A	B	A		A		A
J P-6 Fuel	A	A	A	A	A		A	A	A	A	A		A		A
Kerosene	A	A	B	B	A		A	A	A	A	A	D	A	A	A
Ketchup	D	D	D	D	A		A	B		A	A		A		A
Ketones	A	A	A	A	A		A	A		D	A	D	D		A
Lacquer (and Solvent)	A	A	C	C	A		A	A		D	A	D	D		A
Lactic Acid Concentrated Cold	C	D	D	D	A	D	A	D	A	B	D	B	A	A	A
Lactic Acid Concentrated Hot	C	D	D	D	B	D	A	D	B	C	D	B	B	A	A
Lactic Acid Dilute Cold	A	D	D	D	A	B	A	C	A	B	D	B	A	A	
Lactic Acid Dilute Hot	B	D	D	D	A	D	A	D	B	C	D		D	A	A
Lactose	B	B		C	B		B	B		B	A	B	B		A
Lard	A	B		A	A		A			B	A	C			A
Lard Oil	B	B	C	C	B		A	B		A	A	B	A		A
Lead Acetate	D	C	D	D	B		B	B		A	A	B	B		A
Lead Sulfate	D	C		D	B		B	B		B	A	B	B		A
Lecithin	C	C		C	B		B	B		D	A	D	B		A
Linoleic Acid	A	B	B	B	A		A	B		B	A	D	B		A
Linseed Oil	A	B	A	A	A		A	B		A	A	D	A		A
Lithium Chloride	D	B		B	B		A	B		B	A	B	B		A
LPG	A	A	B	B	B		B	B		A	A	D	A		A
Lubricated Oil Petroleum Base	A	B	A	A	A		A	B		A	A	D	A		A
Ludox	D	D		B	B		B	B		B	B	B	B		A
Magnesium Bisulfate	B	B	B	B	A		A	B		B	A	B	B		A
Magnesium Bisulfide	C	D		D	B		B	B		B	A	B	B		A
Magnesium Carbonate	B	B		B	A		A	B		B	A	B	B		A
Magnesium Chloride	D	B	C	D	B	C	B	B	A	A	A	A	A		A
Magnesium Hydroxide	D	B	B	B	A	A	A	B	B	A	A	A	A		A
Magnesium Hydroxide Hot	D	D	B	B	A	A	A	A	B	B	A		A		A
Magnesium Nitrate	B				A		A	B		B	A		B		A
Magnesium Sulfate	B	B	B	B	A	A	A	B	A	A	A	A	A		A
Maleic Acid	B	B	B	C	B		B	B	A	B	A	D	A		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Maleic Anhydride	B	B		B	B		B	B	B	D	C	D	B		A
Malic Acid	B	B	D	D	B		B	B		A	A		A		A
Malt Beverages					A		B	A		A	A	B	A		A
Manganese Carbonate	B				B		A			B	A				A
Manganese Sulfate	B	B		D	A		A	B		B	A	B	B	A	A
Mayonnaise	D	D	D	D	A		A	B		A	A		A		A
Meat Juices	B	D			A		A			B	A				A
Melamine Resins				D	C		C			B	A				A
Methanol	B	B		B	A		A	B		B	C	D	B		A
Mercuric Chloride	D	D	D	D	B		B	D	B	A	A	A	A		A
Mercuric Cyanide	D	D	D	D	A		A	C	B	A	A	A	A		A
Mercuric Nitrate	D	D			A		A	D			A		B		A
Mercury	D	D	A	A	A		A	B	B	A	A	A	A		A
Methane	A	A	B	B	A		A	B	A	A	A		A		A
Methyl Acetate	A	A	B	B	A		A	B	A	D	B	B	D		A
Methyl Acetone	A	A	A	A	A		A	A		D	B	A	D		A
Methylamine	A	D	B	B	A		A	C	B	D	A	B	D		A
Methyl Bromide 100%	C	C		D	B		A	B		B	A	D	B		
Methyl Cellosolve	A	A	B	B	A		A	B	B	C	A	B	D		A
Methyl Cellulose					A		A		B	D	A				A
Methyl Chloride	D	B	B	B	A		A	B		D	A	D	B		A
Methyl Ethyl Ketone	A	A	A	A	A		A	A	B	D	A	B	D	A	A
Methyl Chloride	C	A	B	B	A		A	B	B	D	A	D	C		A
Methyl Formate	C	A	C	C	B		A	B	B	D	A	B	D		A
Methyl Isobutyle Ketone					A		A			D	A			A	A
Milk and Milk Products	A	B	D	D	A		A	B		A	A	A	A		A
Mineral Oils	A	B	B	B	A		A	A		A	A	D	A		A
Mineral Spirits	A	B	B	B	B		B	B		A	A		A		A
Mixed Acids (cold)	D	D	C	C	B		B	C		D	D	D	B		A
Molasses, crude	B	A	A	A	A		A	A		A	A		A		A
Molasses, Edible	A	A	C	C	A		A	A		A	A		A		A
Molybdic Acid					A		A				A				A
Monochloro Benzene Dry					B		B	B		D	C			A	A
Morpholine	B	B		B	A		A	B		D	A	B	D		A
Mustard	B	A	B	B	A		A	A		A	A		A		A
Naptha	A	B	B	B	B		B	B	A	B	A	D	A		A
Napthalene	B	B	B	B	B		B	B	B	D	A	D	A		A
Natural Gas, Sour	B	B	B	B	A		A	D	A	A	A	D	A		A
Nickel Ammonium Sulfate	D	D	D	D	A		A	C		A	C	B	D		A
Nickel Chloride	D	D	D	D	B		A	B	A	A	D	B	A	A	A
Nickel Nitrite	C	D	D	D	B		A	B		A	C	A	A		A
Nickel Sulfate	D	D	D	D	B		A	B	B	A	C	B	A	A	A
Nicotinic Acid	A	A	B	C	A		A	A		D	C	D	B		A
Nitric Acid 10%	D	D	D	D	A	A	A	D		C	D		A	A	A
Nitric Acid 30%	D	D	D	D	A	D	A	D		C	D	B	A	B	A
Nitric Acid 80%	B	D	D	D	C	D	B	D		D	D	B	B	B	A
Nitric Acid 100%	B	D	D	D	A	D	A	D		D	D	D	B	B	A
Nitric Acid Anhydrous	B	D	D	D	A	D	A	D		D	D	D	A	B	A
Nitrobenzene	C	D	B	B	A		A	B	B	D	B	C	C		A
Nitrogen	A	A	A	A	A		A	A		A	A	B	A		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Nitrous Acid 10%	D	D	D	D	B		B	D		C	B		A		A
Nitrous Gases	B	D	B	C	A		A	D			B				A
Nitrous Oxide	C	B	B	C	B		B	D	B	B	A		A		A
Oils & Fats	B				A		A			B	A	D			A
Oils, Animal	A	A	A	A	A		A	B	A	A	A	B	B		A
Oils, Petroleum Refined	A	B	A	A	A		A	A	A	A	A	D	A		A
Oils, Petroleum Sour	A	C	B	C	A		A	A	A	B	A	D	A		A
Oils, Water Mixture	A	A	B	B	A		A		A	A	A		A		A
Olaic Acid	B				B		B	A		D	C		C		A
Oleic Acid	B	B	C	C	B		A	B	B	B	C	D	A	A	A
Oleum	B	C	B	D	B		B	C	B	D	D	D	C		A
Oleum Spirits	D	D		D	B		B	D		C	D	D	A		A
Olive Oil	B	C	B	B	A		A	A		A	A	B	A		A
Oxalic Acid	C	B	D	D	B	D	B	B		C	C	B	A	A	A
Oxygen	A	A	B	B	A	A	A	A	A	B	D	A	A		A
Ozone, Dry	A	A	A	A	A		A	A	A	D	C	A	B		A
Ozone, Wet	B	B	C	C	A		A	A	A	D	C	B	B		A
Paints & Solvents	A	A	A	A	A		A	A		D	A	D	B		A
Palmitic Acid	B	B	C	C	B		B	B		B	A	B	A		A
Palm Oil	A	B	C	C	B		A	A		B	A	D	A		A
Paper Pulp	D	B		B	A		A	B		B	A	B	B		
Paraffin	A	A	B	B	A		A	A	A	A	A	D	A		A
Paraformaldehyde	B	B	B	B	B		B	B		B	A	D			A
Paraldehyde					B		B			B	A	D		A	A
Pentane	A	A	B	B	A		A	B		A	A	D	A		A
Perchloroethylene, dry	B	C	B	B	A		A	B	B	D	B	D	A		A
Petroleum (Vaseline Petroleum Jelly)	B	B	C	C	B		A	A		A	A		A		A
Phenol	A	B	D	D	A	B	A	A	A	D	C	D	B		A
Phosphate Ester 10%	D	D	A	A	A		A	A		D	A	A			A
Phosphoric Acid 10%	D	D	D	D	D	B	B	D		B	D	B	A	A	A
Phosphoric Acid 50% Cold	D	D	D	D	B	B	B	C		B	D	B	A	A	A
Phosphoric Acid 50% Hot	D	D	D	D	D	D	B	C		B	D	B	A	A	A
Phosphoric Acid 85% Cold	D	D	B	B	A	C	B	A		C	D		B	A	A
Phosphoric Acid 85% Hot	D	D	C	C	B	D	B			C	D			A	A
Phosphoric Anhydride	A				A		A			D	B		B	A	A
Phosphorous Trichloride	D		B	C	A		A			D	D	B	B	A	A
Phthalic Acid	B	B	C	C	B		B	A	B	C	B		A		A
Phthalic Anhydride	B	B	C	C	B		B	A	A	C	A		A		A
Picric Acid	C	C	D	D	B	C	B	D	B	C	D	B	B		A
Pineapple Juice	A	C	C	C	A		A	A		A	A		A		A
Pine Oil	B	B	B	B	A		A	B		A	A	D	A		A
Pitch (Bitumen)					A		A			C	A	D			A
Polysulfide Liquor	D	D		B	B		A	B		B	D	B	B		A
Polyvinyl Acetate	B	B		B	B		B	B			A	B			A
Polyvinyl Chloride	B	B		B	B		B	B			A	B			A
Potassium Bicarbonate	A				A		A	B		B	A				A
Potassium Bichromate	A				A		A	A		B	B		B		A
Potassium Bisulfate	B				A		A	B		B	A		A		A
Potassium Bisulfite	C	C	D	D	B		B	D		A	A	B	A		A
Potassium Bromide	C	C	D	D	A	C	B	B		A	A	B	A		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Potassium Carbonate	D	B	B	B	B	A	B	B		A	A	B	A		A
Potassium Chlorate	C	B	B	B	B	B	B	C		A	A	B	A		A
Potassium Chloride	D	C	C	B	B	B	A	B	B	A	A	A	A		A
Potassium Chromate	B	B		B	B		B	B		B	A	B	B		A
Potassium Cyanide	D	D	B	B	B		B	B	B	A	A	A	A		A
Potassium Dichromate	A	D	C	C	B		A	B		A	A	B	A		A
Potassium Ferricyanide	B	D	C	C	A	B	B	B		A	A	B	A		A
Potassium Ferrocyanide	B	B	C	C	B		B	A		A	A		A		A
Potassium Hydroxide Dilute Cold	D	D	A	A	B	B	B	A		A	D		D		A*
Potassium Hydroxide To 70%, Cold	D	D	B	B	B	C	B	A		B	D	B	D		A*
Potassium Hydroxide Dilute Hot	D	D	B	B	B	C	B	A		B	D				A*
Potassium Hydroxide To 70%, Hot	D	D	A	B	B	D	B	A		C	D	A			A*
Potassium Iodine	D	D	C	C	B	B	B	C		A	A	B	A		A
Potassium Nitrate	A	B	B	B	B	B	B	B	B	A	A	B	A		A
Potassium Oxalate	C				A		A				A				A
Potassium Permanganate	B	B	B	B	B	B	B	B	B	A	A	B	A		A
Potassium Phosphate	D	C		C	B		B	B	B	A	A	A	A		A
Potassium Phosphate Di-basic	B	B	A	A	A		A	B	B	A	A	B	A		A
Potassium Phosphate Tri-basic	D		A	A	B		B	B		B		B			A
Potassium Sulfate	A	B	B	C	A	A	A	B		A	A	A	A		A
Potassium Sulfide	B	B	B	B	A		A	C	A	A	A	B	B		A
Potassium Sulfite	B	B	B	B	A		A	C	B	B	A	A	B		A
Producer Gas	B	B	B	B	B	A	B	A		A	A	D	A		A
Propane Gas	A	A	B	B	B	A	A	B	A	A	A	D	A		A
Propyl Bromide	B	B		B	B		A	B		B	A	B	B		A
Propylene Glycol	A	B	B	B	B		B	B		A	C	B	A		A
Pyridine	B			B	B		A			D	D		D		A
Pyrolgalic Acid	B	B	B	B	B	B	A	B		A	A		A		A
Quench Oil	A	B	B	B	A		A			A	A		A		A
Quinine, Sulfate, dry					A	B	A	B			A				A
Resins & Rosins	A	A	C	C	A	B	A	A		C	A		A		A
Resorcinol					B		B								A
Road Tar	A	A	A	A	A		A	A		B	A	D	A		A
Roof Pitch	A	A	A	A	A		A	A		B	A		A		A
Rosin Emulsion	A	B	C	C	A		A	A		D	A		B		A
R P-1 Fuel	A	A	A	A	A		A	A		B	A		A		A
Rubber Latex Emulsions	A	A	B	B	A		A				A		A		A
Rubber Solvents	A	A	A	A	A		A	A		D	C		D		A
Salad Oil	B	B	C	C	B		A	B		A	A	B	A		A
Salicylic Acid	C	C	D	D	A		B	B		A	A	B	A		A
Salt (NaCl)	B	B	C	C	B		A	A		A	A		A		A
Salt Brine	B	B		D	B		B	B		A	A	B	B		A
Sauerkraut Brine					B		B				C				A
Sea Water	C	C	D	D	B		B	A		A	A	A	A		A
Sewage	C	C	C	D	B	A	B	B		A	B	B	B		A
Shellac	A	A	A	B	A		A	A		A	A				A
Silicone Fluids	B	B		B	B		B			B	A		B		A
Silver Bromide	D				A	C	A	B			D				A
Silver Cyanide	D	D		D	A		A	B		B	D		B		A
Silver Nitrate	D	D	D	D	A		A	D		C	A	A	A		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information *** -** Not with Reinforced or Polyfill

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Silver Plating Sol.	B				A		A				D				A
Soap Solutions (Stearates)	C	A	A	B	A		A	A		A	A	A	A		A
Sodium Acetate	B	B	C	C	B		B	B	B	B	A	B	A		A
Sodium Aluminate	D	B	C	C	A		B	B	B	A	A	B	A		A
Sodium Benzoate	B				B		B	B			B				A
Sodium Bicarbonate	B	B	C	C	B		A	B		A	B	A	A		A
Sodium Bichromate	A				B		B			D	A				A
Sodium Bisulfate 10%	D	B	D	D	A		A	B		A	D	B	A		A
Sodium Bisulfite 10%	D	B	D	D	A		B	B	B	A	D	B	A		A
Sodium Borate	B	B	C	C	B		B	B		A	A	B	A		A
Sodium Bromide 10%	B	B	C	D	B		B	B		A	A	B	A		A
Sodium Carbonate (Soda Ash)	D	B	B	B	A		A	B	B	A	A	B	A		A
Sodium Chlorate	C	B	C	C	B		B	C	B	A	A	B	A	B	A
Sodium Chloride	B	B	C	C	B		A	A	B	A	A	B	A	A	A
Sodium Chromate	D	C	B	B	A		B	B		A	A	B	A		A
Sodium Citrate	D				B		B				A				A
Sodium Cyanide	D	D	B	B	A	B	A	B		A	A	B	A		A
Sodium Ferricyanide	A				A		A	B			A				A
Sodium Fluoride	C	C	D	D	B	B	A	B		A	A	B	A		A
Sodium Hydroxide 20% Cold	D	A	A	A	A	A	B	A		A	D	B	B	A	A*
Sodium Hydroxide 20% Hot	D	A	B	B	A	C	A	A		B	D	B	C	A	A*
Sodium Hydroxide 50% Cold	D	A	A	B	A	B	A	A		A	D	B	C	A	A*
Sodium Hydroxide 50% Hot	D	A	B	B	A	C	A	B		B	D		C	A	A*
Sodium Hydroxide 70% Cold	D	A	A	A	A	B	B	A		B	D	B	C	A	A*
Sodium Hydroxide 70% Hot	D	B	B	B	A	C	B	B		D	D	B	C	A	A*
Sodium Hypochlorite (Bleach)	D	D	D	D	D	D	C	D	A		D		A		A
Sodium Hyposulfite	B				B		B	B			A				A
Sodium Lactate	D				A		A	B			A				A
Sodium Metaphosphate	A	C	B	C	B	B	B		A	A	B	B		A	
Sodium Metasilicate Cold	B	B	C	C	A		A	A		B	A		B		A
Sodium Metasilicate Hot	B	B	D	D	A		A	A	A		A				A
Sodium Nitrate	A	B	B	B	A	B	A	B	B	C	A	B	A		A
Sodium Nitrite	A				B		B	C	B	C	B	A	B		A
Sodium Perborate	B	B	B	B	B	B	B	B	B	C	A	A	A		A
Sodium Peroxide	C	D	C	C	B	B	B	B	B	C	A	A	A		A
Sodium Phosphate	D	C	C	C	B	B	B	B	B	B	B	A	A		A
Sodium Phosphate Di-basic	D	C	C	C	B		B	B	B	A	A	A	A		A
Sodium Phosphate Tri-basic	D	C	C	C	B		B	B	B	B	A	A	A		A
Sodium Polyphosphate					B		B	B	B	B		A			A
Sodium Salicylate					A		A				A				A
Sodium Silicate	B	B	B	B	B		B	B		A	A	B	A		A
Sodium Silicate, Hot	C	C	C	C	B		B	B			A	B			A
Sodium Sulfate	B	B	B	B	A	B	A	A		A	A	A	A		A
Sodium Sulfide	C	D	B	B	B	A	B	B		A	A	B	A		A
Sodium Sulfite	B	C		A	A	A	A	B	B	A	A	B	B		A
Sodium Tetraborate				A	A		A			A	A	B			A
Sodium Thiosulfate	B	C	B	C	B	A	B	B		A	A	A	A		A
Soybean Oil	B	B	C	C	A		A	A		A	B	B	A		A
Starch	B	B	C	C	B		A	A		A	A	C	A		A
Steam (212° F)	A	A	A	A	A	A	A	B		D	D	B	C	A	A

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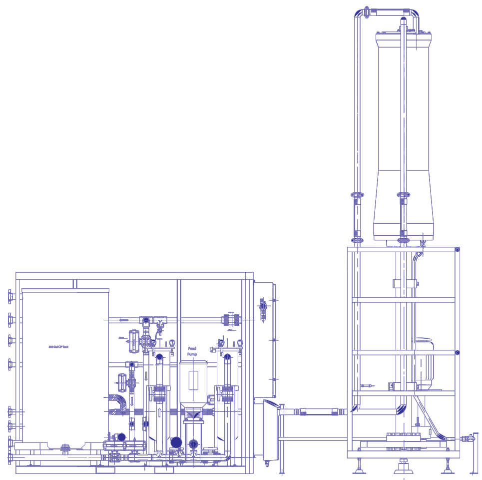

Proyecto: Planta de Tratamiento de Lixiviados del Complejo Ambiental de Santo Domingo de los Tsachilas
Jefe de Proyecto: Christian Lemos - Ernesto Bastidas
Locacion: Santo Domingo, Ecuador
Aplicacion: Lixiviado de Relleno Sanitario

Relleno Sanitario Santo Domingo de los Tsachilas

Fabricante:

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Relleno Sanitario
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de los Tsachilas

Consorcio
E y E

Process Engineering

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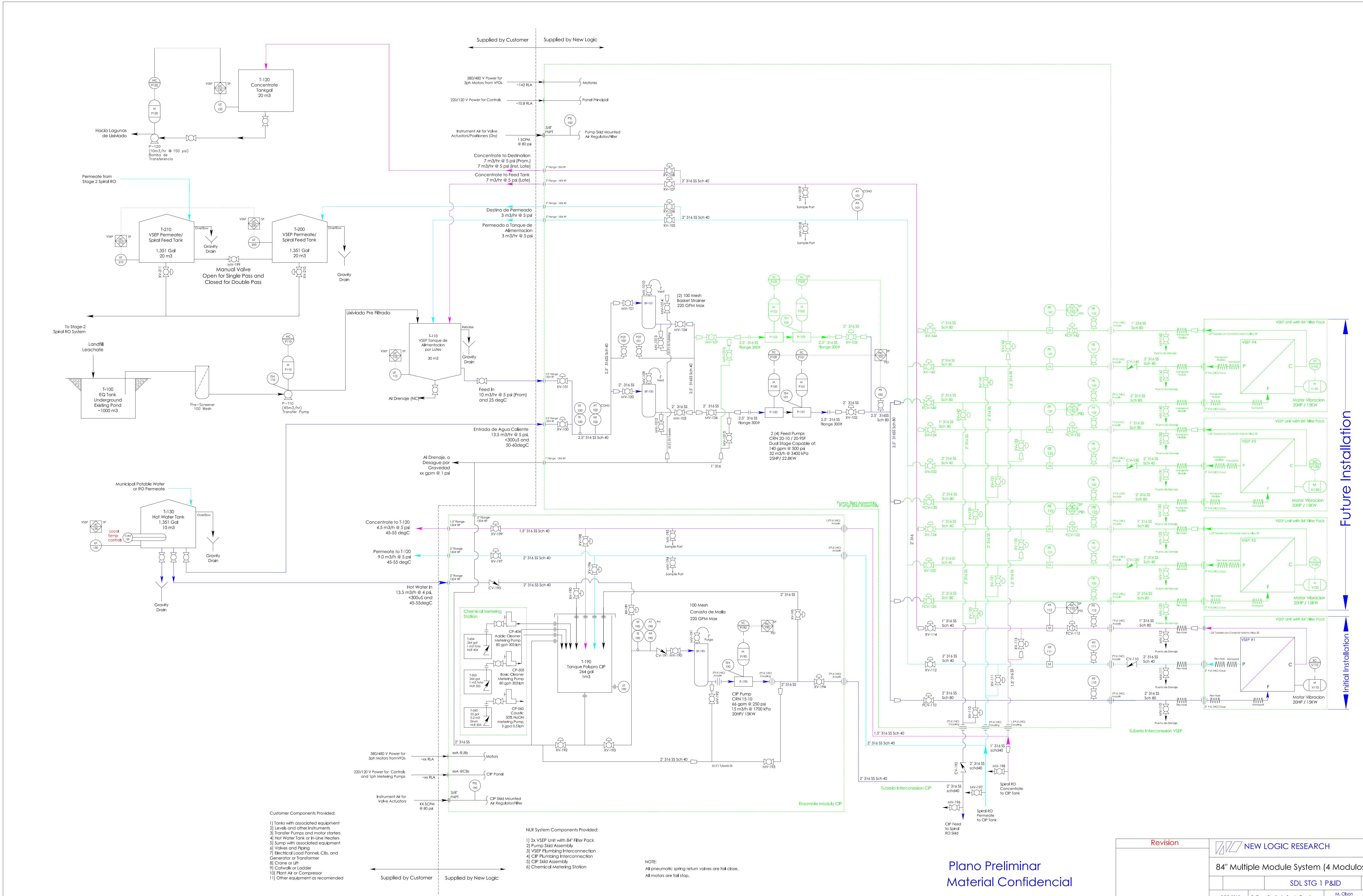
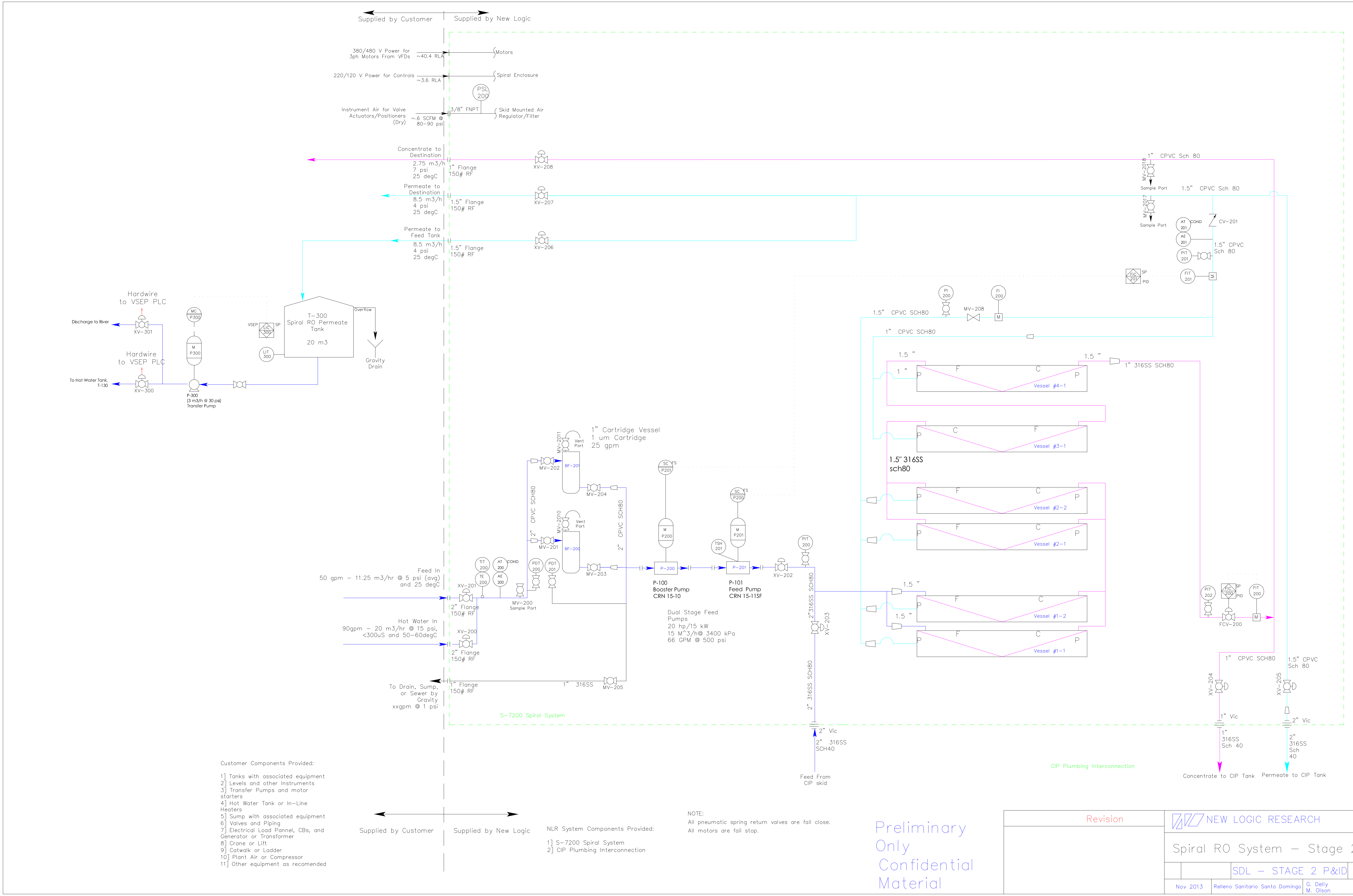
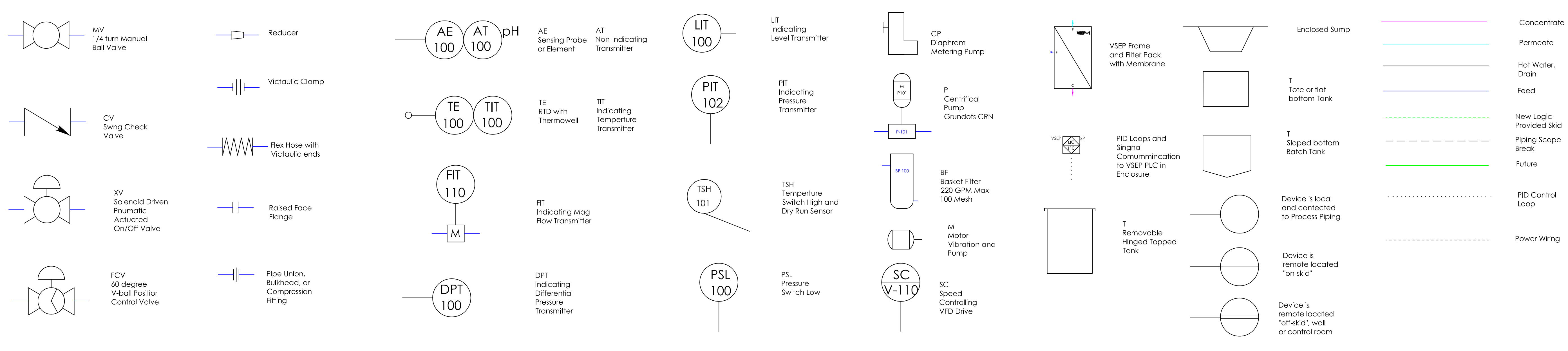


Supplied by Customer
Supplied by New Logic
380/480 V Power for 3ph Motors from VFDs
~142 RLA
Motores
220/120 V Power for Controls
~10.8 RLA
Panel Principal
Instrument Air for Valve Actuators/Positioners (Dry)
1 SCFM @ 80 psi
3/8" FNPT
Pump Skid Mounted Air Regulator/Filter
T-120 Concentrate Tankgal 20 m3
Hacia Lagunas de Lixiviado
P-120 (10m3/hr @ 150 psi) Bomba de Transferencia
Concentrate to Destination 7 m3/hr @ 5 psi (Prom.) 7 m3/hr @ 5 psi (Inst. Lote)
Concentrate to Feed Tank 7 m3/hr @ 5 psi (Lote)
Permeate from Stage 2 Spiral RO
T-210 VSEP Permeate/ Spiral Feed Tank 1,351 Gal 20 m3
T-200 VSEP Permeate/ Spiral Feed Tank 1,351 Gal 20 m3
Overflow
Gravity Drain
Manual Valve Open for Single Pass and Closed for Double Pass
Destino de Permeado 3 m3/hr @ 5 psi
Permeado a Tanque de Alimentacion 3 m3/hr @ 5 psi
To Stage-2 Spiral RO System
Lixiviado Pre Filtrado
T-110 VSEP Tanque de Alimentacion por Lotes 30 m3
Landfill Leachate
T-100 EQ Tank Underground Existing Pond ~1000 m3
Pre-Screener 100 Mesh
P-110 (45m3/hr) Transfer Pump
Feed In 10 m3/hr @ 5 psi (Prom) and 25 degC
Al Drenaje (NC)
(2) 100 Mesh Basket Strainer 220 GPM Max
2 (4) Feed Pumps CRN 20-10 / 20-95F Dual Stage Capable of: 140 gpm @ 500 psi 32 m3/h @ 3400 kPa 25HP/ 22.8KW
Entrada de Agua Caliente 13.5 m3/hr @ 5 psi. <300uS and 50-60degC
Al Drenaje, o Desague por Gravedad xx gpm @ 1 psi
Pump Skid Assembly
Municipal Potable Water or RO Permeate
T-130 Hot Water Tank 1,351 Gal 10 m3
Local Temp control
Concentrate to T-120 4.5 m3/h @ 5 psi 45-55 degC
Permeate to T-120 9.0 m3/h @ 5 psi 45-55 degC
Hot Water In 13.5 m3/h @ 4 psi. <300uS and 45-55degC
Sample Port
Chemical Metering Station
CP-404 Acidic Cleaner Metering Pump 80 gph 303 lph
CP-505 Basic Cleaner Metering Pump 80 gph 303 lph
CP-560 Caustic 50% NaOH Metering Pump 3 gpd 0.5 lph
T-190 Tanque Polypro CIP 264 gal 1 m3
100 Mesh Canasta de Malla 220 GPM Max
CIP Pump CRN 15-10 66 gpm @ 250 psi 15 m3/h @ 1700 kPa 20HP/ 15KW
Ensamble Modulo CIP
380/480 V Power for 3ph Motors from VFDs
220/120 V Power for Controls and 1ph Metering Pumps
Instrument Air for Valve Actuators
XX SCFM @ 80 psi
CIP Skid Mounted Air Regulator/Filter
Tuberia Interconexion CIP
Spiral RO Concentrate to CIP Tank
Spiral RO Permeate to CIP Tank
CIP Feed to Spiral RO Skid
Tuberia Interconexion VSEP
VSEP Unit with 84" Filter Pack
Motor Vibracion 20HP / 15KW
Future Installation
Initial Installation
Customer Components Provided:
1] Tanks with associated equipment
2] Levels and other Instruments
3] Transfer Pumps and motor starters
4] Hot Water Tank or In-Line Heaters
5] Sump with associated equipment
6] Valves and Piping
7] Electrical Load Pannell, CBs, and Generator or Transformer
8] Crane or Lift
9] Catwalk or Ladder
10] Plant Air or Compressor
11] Other equipment as recomended
NLR System Components Provided:
1] 2x VSEP Unit with 84" Filter Pack
2] Pump Skid Assembly
3] VSEP Plumbing Interconnection
4] CIP Plumbing Interconnection
5] CIP Skid Assembly
6] Chemical Metering Station
NOTE:
All pneumatic spring return valves are fail close.
All motors are fail stop.
Plano Preliminar
Material Confidencial
Revision
NEW LOGIC RESEARCH
84" Multiple Module System (4 Modulos)
SDL STG 1 P&ID
DEC 2013
Relleno Sanitario Santo Domingo
M. Olson
G. Delly


Supplied by Customer
Supplied by New Logic
380/480 V Power for 3ph Motors From VFDs
~40.4 RLA
Motors
220/120 V Power for Controls
~3.6 RLA
Spiral Enclosure
PSL 200
Instrument Air for Valve Actuators/Positioners (Dry)
~.6 SCFM @ 80-90 psi
3/8" FNPT
Skid Mounted Air Regulator/Filter
Concentrate to Destination
2.75 m3/h
7 psi
25 degC
1" Flange 150# RF
XV-208
1" CPVC Sch 80
MV-2018
Sample Port
Permeate to Destination
8.5 m3/h
4 psi
25 degC
1.5" Flange 150# RF
XV-207
1.5" CPVC Sch 80
MV-2017
Sample Port
CV-201
AT 201 COND
AE 201
PIT 201
1.5" CPVC Sch 80
Permeate to Feed Tank
8.5 m3/h
4 psi
25 degC
1.5" Flange 150# RF
XV-206
FIC 201
SP
PID
FIT 201
Hardwire to VSEP PLC
Discharge to River
XV-301
MC P300
T-300
Spiral RO Permeate Tank
20 m3
Overflow
VSEP
LIC 300
SP
LIT 300
Gravity Drain
Hardwire to VSEP PLC
To Hot Water Tank, T-130
XV-300
P-300
(3 m3/h @ 30 psi)
Transfer Pump
PI 200
FI 200
1.5" CPVC SCH80
MV-208
1" CPVC SCH80
1.5 "
1.5 "
1" 316SS SCH80
1 "
F
C
P
P
Vessel #4-1
C
F
P
Vessel #3-1
1.5" 316SS
sch80
F
C
P
P
Vessel #2-2
F
C
P
P
Vessel #2-1
1.5 "
1.5 "
F
C
P
P
Vessel #1-2
F
C
P
P
Vessel #1-1
1" Cartridge Vessel
1 um Cartridge
25 gpm
MV-2011
Vent Port
MV-202
BF-201
MV-204
MV-2010
Vent Port
MV-201
BF-200
MV-203
2" CPVC SCH80
2" CPVC SCH80
SC P201
FS
SC P200
FS
TSH 201
M P200
M P201
P-200
P-201
P-100
Booster Pump
CRN 15-10
P-101
Feed Pump
CRN 15-11SF
XV-202
PIT 200
2" 316SS SCH80
XV-203
Dual Stage Feed Pumps
20 hp/15 kW
15 M^3/h@ 3400 kPa
66 GPM @ 500 psi
PIT 202
FIC 200
SP
PID
FIT 200
FCV-200
Feed In
50 gpm - 11.25 m3/hr @ 5 psi (avg)
and 25 degC
TIT 200
TE 200
AT 200 COND
AE 200
PDT 200
PDT 201
XV-201
2" Flange 150# RF
MV-200
Sample Port
Hot Water In
90gpm - 20 m3/hr @ 15 psi,
<300uS and 50-60degC
XV-200
2" Flange 150# RF
To Drain, Sump, or Sewer by Gravity
xxgpm @ 1 psi
1" Flange 150# RF
1" 316SS
MV-205
S-7200 Spiral System
2" 316SS SCH80
2" Vic
2" 316SS SCH40
Feed From CIP skid
1" CPVC SCH80
1.5" CPVC Sch 80
XV-204
XV-205
1" Vic
1" 316SS Sch 40
2" Vic
2" 316SS Sch 40
CIP Plumbing Interconnection
Concentrate to CIP Tank
Permeate to CIP Tank
Customer Components Provided:
1] Tanks with associated equipment
2] Levels and other Instruments
3] Transfer Pumps and motor starters
4] Hot Water Tank or In-Line Heaters
5] Sump with associated equipment
6] Valves and Piping
7] Electrical Load Pannel, CBs, and Generator or Transformer
8] Crane or Lift
9] Catwalk or Ladder
10] Plant Air or Compressor
11] Other equipment as recomended
Supplied by Customer
Supplied by New Logic
NLR System Components Provided:
1] S-7200 Spiral System
2] CIP Plumbing Interconnection
NOTE:
All pneumatic spring return valves are fail close.
All motors are fail stop.
Preliminary Only Confidential Material
Revision
NEW LOGIC RESEARCH
Spiral RO System - Stage 2
SDL - STAGE 2 P&ID
Nov 2013
Relleno Sanitario Santo Domingo
G. Delly
M. Olson

P&ID Symbols Legend



Notes:
NLR Confidential Material
For Reference Only.

Revision	NEW LOGIC RESEARCH
	P&ID Symbols Legend
	P&ID
	June 2012 M. Ayers G. Chauhan

ID		Task Name	Duration	Start	Finish	Predecessors
1		**SDL Project - Preliminary Timeline Summary**	**99 days**	**Tue 11/19/13**	**Fri 4/4/14**	
2						
3		**Planning**	**41 days**	**Tue 11/19/13**	**Tue 1/14/14**	
4		Received First Payment	1 day	Tue 11/19/13	Tue 11/19/13	
5		Create and Send out engineering drawings to customer	12 days	Wed 11/20/13	Thu 12/5/13	4
6		Customer receives&reviews eng documents.	12 days	Fri 12/6/13	Mon 12/23/13	5
7		Conference Call and Customer Returns Signoff sheets	0 days	Mon 12/23/13	Mon 12/23/13	6
8		Order final bill of materials.	1 day	Tue 12/24/13	Tue 12/24/13	7
9		Process/Drafting dept distributes final design pkg to manufacturing dept.	1 day	Tue 12/24/13	Tue 12/24/13	6
10		Receive materials.	15 days	Wed 12/25/13	Tue 1/14/14	8
11						
12		**Manufacturing**	**54 days**	**Tue 12/24/13**	**Fri 3/7/14**	
13		**Skid-1 (Pump Skid)**	**36 days**	**Wed 1/15/14**	**Wed 3/5/14**	
14		Cut skid metal	3 days	Wed 1/15/14	Fri 1/17/14	10
15		Weld the skid	3 days	Mon 1/20/14	Wed 1/22/14	14
16		Powder-coat skid frame	5 days	Thu 1/23/14	Wed 1/29/14	15
17		Cut & machine pipe	3 days	Mon 1/20/14	Wed 1/22/14	14
18		Tack weld pipe	3 days	Thu 1/23/14	Mon 1/27/14	17
19		Mock up pipe	3 days	Thu 1/30/14	Mon 2/3/14	18,16
20		Weld pipe	3 days	Tue 2/4/14	Thu 2/6/14	19
21		Fit up and electropolish the piping	7 days	Fri 2/7/14	Mon 2/17/14	20
22		Intrumentation and Electrical fabrication. Finish final fabrication	12 days	Tue 2/18/14	Wed 3/5/14	21
23		**Skid-2 (CIP)**	**35 days**	**Mon 1/20/14**	**Fri 3/7/14**	
24		Cut skid metal	1 day	Mon 1/20/14	Mon 1/20/14	14
25		Weld the skid	3 days	Thu 1/23/14	Mon 1/27/14	15
26		Powder-coat skid frame	5 days	Thu 1/30/14	Wed 2/5/14	16
27		Cut & machine pipe	1 day	Thu 1/23/14	Thu 1/23/14	17
28		Tack weld pipe	3 days	Tue 1/28/14	Thu 1/30/14	18
29		Mock up pipe	3 days	Thu 2/6/14	Mon 2/10/14	28,26
30		Weld pipe	4 days	Tue 2/11/14	Fri 2/14/14	29
31		Fit up and electropolish the piping	7 days	Mon 2/17/14	Tue 2/25/14	30
32		Intrumentation and Electrical fabrication. Finish final fabrication	8 days	Wed 2/26/14	Fri 3/7/14	31
33		**Skid-3 (IC pipe and metering pump station)**	**16 days**	**Fri 1/24/14**	**Fri 2/14/14**	
34		Cut skid metal	1 day	Fri 1/24/14	Fri 1/24/14	27
35		Weld the skid	1 day	Mon 1/27/14	Mon 1/27/14	34
36		Powder-coat skid frame	5 days	Tue 1/28/14	Mon 2/3/14	35
37		Cut tubing	1 day	Tue 2/4/14	Tue 2/4/14	36
38		Pumps and Electrical fabrication. Finish final fabrication	1 day	Wed 2/5/14	Wed 2/5/14	37
39		Cut & machine IC pipe	1 day	Fri 1/24/14	Fri 1/24/14	27
40		Tack weld IC pipe	2 days	Fri 1/31/14	Mon 2/3/14	28
41		Mock up IC pipe	1 day	Tue 2/4/14	Tue 2/4/14	40
42		Weld IC pipe	3 days	Wed 2/5/14	Fri 2/7/14	41
43		Fit up IC and electropolish the piping	5 days	Mon 2/10/14	Fri 2/14/14	42
44		metering skid and tubing	3 days	Mon 1/27/14	Wed 1/29/14	39
45		Filter Pack & VSEP fabrication and testing	8 wks	Tue 12/24/13	Mon 2/17/14	7
46		**Testing**	**16 days**	**Mon 3/10/14**	**Mon 3/31/14**	
47		System installed in wet test area	5 days	Mon 3/10/14	Fri 3/14/14	43,44,22,32,45
48		Load Program and Debug	5 days	Mon 3/17/14	Fri 3/21/14	47
49		Testing system in wet test area and carring out Quality Control	5 days	Mon 3/24/14	Fri 3/28/14	48
50		Customer Inspection and FAT	1 day	Mon 3/31/14	Mon 3/31/14	49
51						
52		**Packing and Shipping**	**4 days**	**Tue 4/1/14**	**Fri 4/4/14**	
53		Unistall system from wet test area	2 days	Tue 4/1/14	Wed 4/2/14	50
54		System is crated ready for pick up	2 days	Thu 4/3/14	Fri 4/4/14	53

NEW LOGIC RESEARCH
1295 67th Street Emeryville California 94608-1120 Phone: (510) 655-7305 Fax: (510)655-7307

Contact Information for New Logic Research

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Wiring Instructions:
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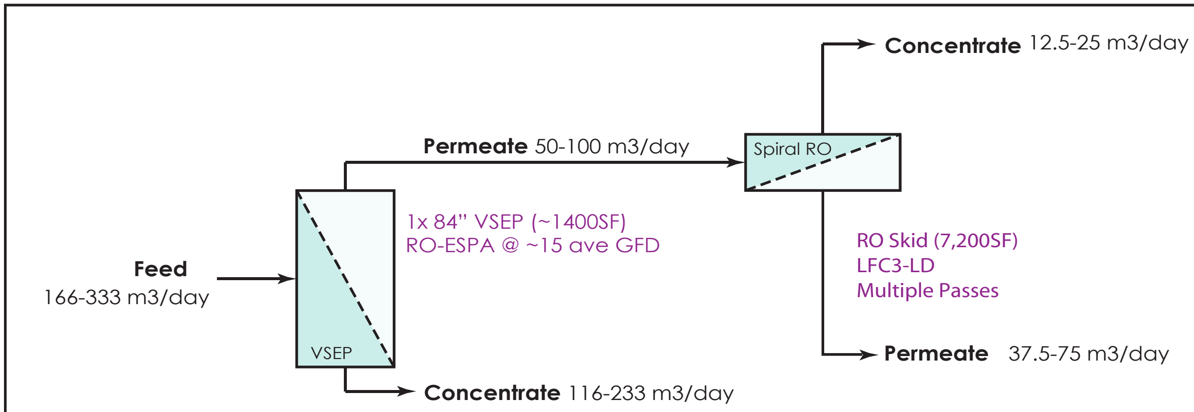
Account # 03-308376 RTN #
121000248 Walls Fargo Bank
N.A. 3640 Mt. Diablo Blvd.
Lafayette, CA U.S.A. 94549
SWIFT: WFBIUS6S

Filtration of Landfill Leachate
“Single Pass-Constant Flow” Process Flow Diagram

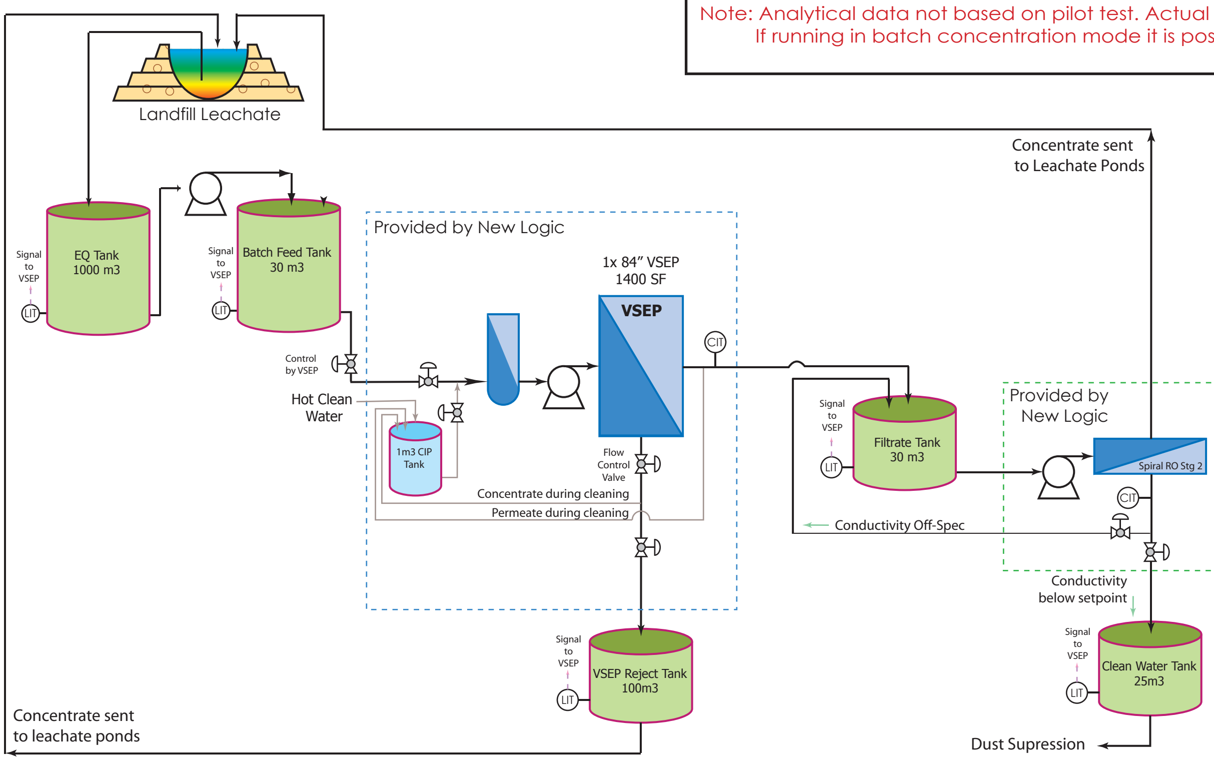
VSEP Advantages:
Minimal/No Chemical Addition and Pre-Treatment
Automated Controls
Remote Monitoring
Small Footprint
Energy Efficient

Membrane: RO ESPA & Spiral LFC3-LD

Cleaning: NLR 404 & 505



Note: Analytical data not based on pilot test. Actual data may vary. Data shown based on SIngle Pass operation mode. If running in batch concentration mode it is possible to reach 75% Recovery.



Controls:

The automatic VSEP process is controlled with a PLC. There are PID loops for the inlet pressure and concentrate flow rate. This is accomplished using VFD's and throttling valves, respectively. The filtration method available for use will be Single Pass-Constant Flow. This method is done by filling the feed tank and then running in filtration mode, removing permeate and concentrate from the batch feed tank as a single pass. The concentrate will be sent back to the leachate ponds. The feed tank level is maintained at a set point by the transfer pump.

After a system shut down due to low feed tank level, or after any shut down, the system would auto flush using hot water and then go into Stanby Mode. On start up after flushing with water, the discharge from the VSEP would go to drain for a set time interval until all water has been purged. Then the discharge from the VSEP diverts to the appropriate holding tanks. VSEPs will automatically clean at a predetermined timed interval.

Preliminary drawing for engineering discuision only. Please see P&ID for details.

NEW LOGIC Research 1295 67th Street, Emeryville, CA 94608 (510) 655-7305	
Samto Domingo Landfill Leachate	11/20/2013
SDL Process Flow Diagram	

Utility Summary					New Logic Research
VSEP System				Rev:	A

AIR CONSUMPTION

	# of Valves	In^3 Air/stroke	Strokes/day	CFM	M3/hr
1 VSEP - Stage 1					
1" Pneumatic Valves	2	16.5	20	0.0003	0.0005
1.5" Pneumatic Valves	2	35	20	0.0006	0.0010
2" Pneumatic Valves	16	60	20	0.0077	0.0131
2.5" Pneumatic Valves	2	94	20	0.0015	0.0026
1" Flow Control Valves	1	35	20	0.5003	0.8505
2" Flow Control Valves	1	60	20	0.5005	0.8508
7200 Spiral - Stage 2					
1" Pneumatic Valves	2	16.5	20	0.0003	0.0005
1.5" Pneumatic Valves	3	35	20	0.0008	0.0014
2" Pneumatic Valves	4	60	20	0.0019	0.0033
1" Flow Control Valves	1	35	20	0.5003	0.8505
			System Totals	**1.51**	**2.574**

System Air Totals

Supply air to FCVs at 80-90 psi (560-630 kPa)

Supply air to Regulator/Filter at 80-90 psi 3/8" NPT Connection (CIP, Spiral, and Instrument Enclosure)

CLEANING WATER CONSUMPTION

(Use Hot Water for cleaning water >300 uS/cm)

	# /Day	Temp degC	Gallons/Day	GPM	M3/hr
1 VSEP Stage 1					
Cleanings (1 VSEP Modules)	1	50-60	1700	1.18	0.268
Rinse filter pack at 60gpm for 5mins	1	50-60	300	0.21	0.0473
Intermittent need of additional cleaning or flush of filter pack (Alarms)	0.14	50-60	42	0.03	0.0066
7200 Spiral - Stage 2					
Cleanings	0.14	50-60	294	0.20	0.05
Rinse, 80 gpm for 10mins	0.14	50-60	112	0.08	0.02
			System Totals	**1.70**	**0.3859**

System Water Totals

Supply water to at 20 psi 2" flange connection on CIP skid, 3" Pump Skid connection, and 2" Spiral Skid Connection

Supply Water at 50-60degC and 60gpm (13.5m3/hr)

ELECTRICAL CONSUMPTION

Based on 440 VAC, 3 phase, 60hz Input

FLA = Full Load Amps = Full Load Drive Output x 1.15x

RLA = Running Load Amps = FLA x .65x

VSEP 440 VAC Motors

	# Motors	HP /ea	kW /ea	Amps /ea	FLA /ea	RLA /ea	Total kW	Total FLA	Total RLA
1 VSEP Stage 1									
VSEP Drive Motor	1	20	15.2	27.0	31.1	20.2	15.2	31.1	20.2
VSEP Feed Pump	2	25	19.0	34.0	39.1	25.4	38.0	78.2	50.8
CIP Pump Motor	1	20	15.2	27.0	31.1	20.2	15.2	31.1	20.2
7200 Spiral - Stage 2									
Spiral Feed Pump	2	20	15.2	27.0	31.1	20.2	30.4	62.1	40.4
System Totals	**6**						**98.8**	**202.4**	**131.6**

Supply power to from customer supplied Load Pannel to a the VFD and then from VFD to each motor junction box

VSEP + Spiral 220 VAC									
Main Control Enclosures	4			4.8	5.5	3.6		22.1	14.4
Metering Pumps	2	0.75	0.6	4.8	5.5	3.6	1.1	11.0	7.2
System Totals	**6**						**1.1**	**33.1**	**21.5**

Supply power to circuit breakers in Main, CIP, and Spiral Enclosures

Note:

1. These are estimates only based on very preliminary data. These calculations are subject to change

2. Off-skid equipment not included. Size larger transformer to include transfer pumps, lighting, and other offskid items.

System Size Calculations

Landfill Leachate

V✧SEP®

V✧SEP® - Filtration is Finally an Option

			84" ESPA VSEP				8" LFC Spiral	
Given:								
Average Test Permeate Flux	15	GFD	26	LMH	5	GFD	9	LMH
% Recovery	30%		30%		75%		75%	
Feed Flow	44.30	GPM	10,061	LPH	13.29	GPM	3,018	LPH
Permeate Flow	13.29	GPM	3,018	LPH	9.97	GPM	2,264	LPH
Concentrate Flow	31.01	GPM	7,042	GPM	3.32		755	
Filter Size	1,400	SF	129	SM	400	SF	37	SM
Frequency of Cleanings	1	days	1	days	7	days	7	days
Length of Down Time for Cleaning	2	hours	2	hours	2	hours	2	hours
Frequency of Maintenance	7	days	7	days	31	days	31	days
Length of Down Time for Maintenance	1	hours	1	hours	1	hours	1	hours
Number of 5 minute flushes/day	0	ea	0	ea	0	ea	0	ea
Overdesign to account for Flux sag	30%		30%		50%		50%	
Calculated Values from Data Above								
Requested Production (Feed)	63,792	gpd	241,453	lpd	19,138	gpd	72,436	lpd
Permeate Production	19,138	gpd	72,436	lpd	14,353	gpd	54,327	lpd
Hours/day of filtration operation	21.9	hours	21.9	hr	23.7	hours	23.7	hr
Expected Permeate Production								
Average production of one module	19,125	gpd	72,388	lpd	1,974	gpd	7,470	lpd
Modules Recommended								
Number of modules with no Overdesign	1.0		1.0		7.3		7.3	
Number of modules with Overdesign	1.3		1.3		10.9	*	10.9	*

NEW LOGIC RESEARCH

1295 67th Street Emeryville California 94608-1120 Phone: (510) 655-7305 Fax: (510)655-7307

3.1 Control System Summary – SDL Santo Domingo Landfill

Preliminary Electrical Info

Customer: SDL Santo Domingo Landfill
Location: Santo Domingo, Ecuador
Feed Material: Landfill Leachate

The final system controls design will be the results of detailed engineering and discussion between New Logic Research and the client. For the purpose of establishing a baseline, the following preliminary controls design is provided. It is not suggested that the following be a final system design. This information is only given for the purpose of describing the framework for controls design and how to start thinking about it.

3.1.1 Method of Control and Monitoring

The VSEP Filtration System will have a local control system. It will be possible to operate the system entirely from the local control panel. The system will consist of a Compact Logix PLC and a Versa View Industrial Computer with FT View SE HMI software. The computer has the capability of remote access via gotomypc.com. Remote access will allow monitoring and troubleshooting by New Logic engineers and will also allow any user to monitor the system data over the internet with a password. This is accomplished using Ethernet connections and a modem. It is recommended that New Logic be given access to real time data so that we can assist with ongoing service and support. This service is provided by New Logic at no cost to the customer and will help to improve overall system performance and reliability, especially during the early periods of operation when operators are still learning the functionality of VSEP.

The connections to the DCS can be accomplished by one the following:

1. VSEP PLC communicating directly to the DCS PLC, transferring requested sensor information.
2. VSEP PLC to a second HMI (duplicating FT View SE Screens).
3. VSEP PLC to DCS HMI (adding VSEP screens to the DCS screens).

Note: all of the above connections are accomplished by using an Ethernet connection.

3.1.2. Wiring Method

The central system will consist of Ethernet. The local VSEP control system consisting of PLC and HMI display panel will communicate over Ethernet network. VSEP system skids will have a control enclosure containing the Flex I/O modules. Ethernet will be used as a communication cable between the Flex I/O modules and the central PLC. The control enclosure will include a solenoid rack to control pneumatic valves, these racks will be factory wired to the I/O modules. Off skid sensors are typically hard wired to I/Os on the main enclosure.

The VSEP System Skid will require the following field interconnecting wiring for controls, **provided by New Logic**:

1. 24VDC or 220 VAC 5-15 amp power for devices
2. 4-20 mA signal wire for devices
3. Ethernet connections between HMI, Switch, and PLC
4. Ethernet Net to Flex I/O.

The VSEP System will require the following field interconnecting wiring for controls, **provided by others:**

5. 440VAC Power supply from VFDs in the Motor Control Center to the Motor Junction Boxes.
6. Power supply to the VFDs, or, if remote located in a Motor Control Center, to the Motor Junction Boxes
7. Ethernet to Flex I/O in CIP Enclosure
8. Ethernet communication cabling from the VSEP System to the DCS and/or Internet.
9. Ethernet to VFDs in MCC.
10. Managed Ethernet Switch
11. 4-20mA wiring to the level indicators located on the storage tanks.
12. 24 VDC wiring to transfer pump and off skid on/off valves
13. 220 VAC Control wiring power supply to the Main and CIP Enclosures
14. 220 VAC power wiring to metering pumps

3.1.3 440 VAC Power Summary

1). VSEP Feed Pump Skid:
The 440 VAC, 3 phase load is comprised of 3 Variable Frequency Drives that runs 2 feed pumps and 1 vibration drive motors.
Vibration VFD Model: AC Tech SMV Series ESV153E04TXD
There is 1 x 20 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.
Pump VFD Model: AC Tech SMV Series ESV233E04TXD
There are 2 x 25 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 39 Amps, 25HP, NEMA 4/12, English.

2). For the VSEP CIP Skid:
The 440 VAC, 3 phase load is comprised of 1 Variable Frequency Drive that will run 1 CIP pump.
Pump VFD Model: AC Tech SMV Series ESV153E04TXD
There is 1 x 20 Hp CIP Pump Drive VFD
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.

3). Stage-2 Spiral Feed Pump Skid:
The 440 VAC, 3 phase load is comprised of 2 Variable Frequency Drives that runs 2 feed pumps motors.
Vibration VFD Model: AC Tech SMV Series ESV153E04TXD
There are 2 x 20 HP VSEP Vibration VFD's
AC Tech Drive, 440 VAC, 3 Phase, 31 Amps, 20HP, NEMA 4/12, English.

3.1.4 Full Load Power Rating:
440 VAC System Full Load Power Rating
Estimates are based on the maximum output rating for the Variable Frequency Drives, multiplied by 1.15

440 VAC 3 Phase. Total Maximum "Full Load Amps" FLA= 202.4 Amps

- Vibration Motor: 1 Circuit, 31.1 Amps Each
- VSEP Feed Pumps: 4 Circuits, 39.1 Amps Each
- CIP Pumps: 1 Circuit: 31.1 Amps Each.
- Spiral Feed Pumps: 2 Circuits, 31.1 Amps Each

From actual experience in the past, a more realistic estimate of the Full Load on the system would be 65% of the above estimate.

Actual predicted total RLA = 131.6 Amps

3.1.5 Variable Frequency Drive Control

The AC Tech drives will be connected by instrumentation cable to the Input/Output boards. The VSEP system Central PLC will send "Run", "Stop", and "Speed Control" signals. The VSEP system Central PLC will read "Run Confirm" and "Motor Load" signals.

3.1.6 Installation Conditions to be Resolved

1. VFDs will be provided by New Logic which will be NEMA 4 construction. They will be set up for remote installation wall or MCC.

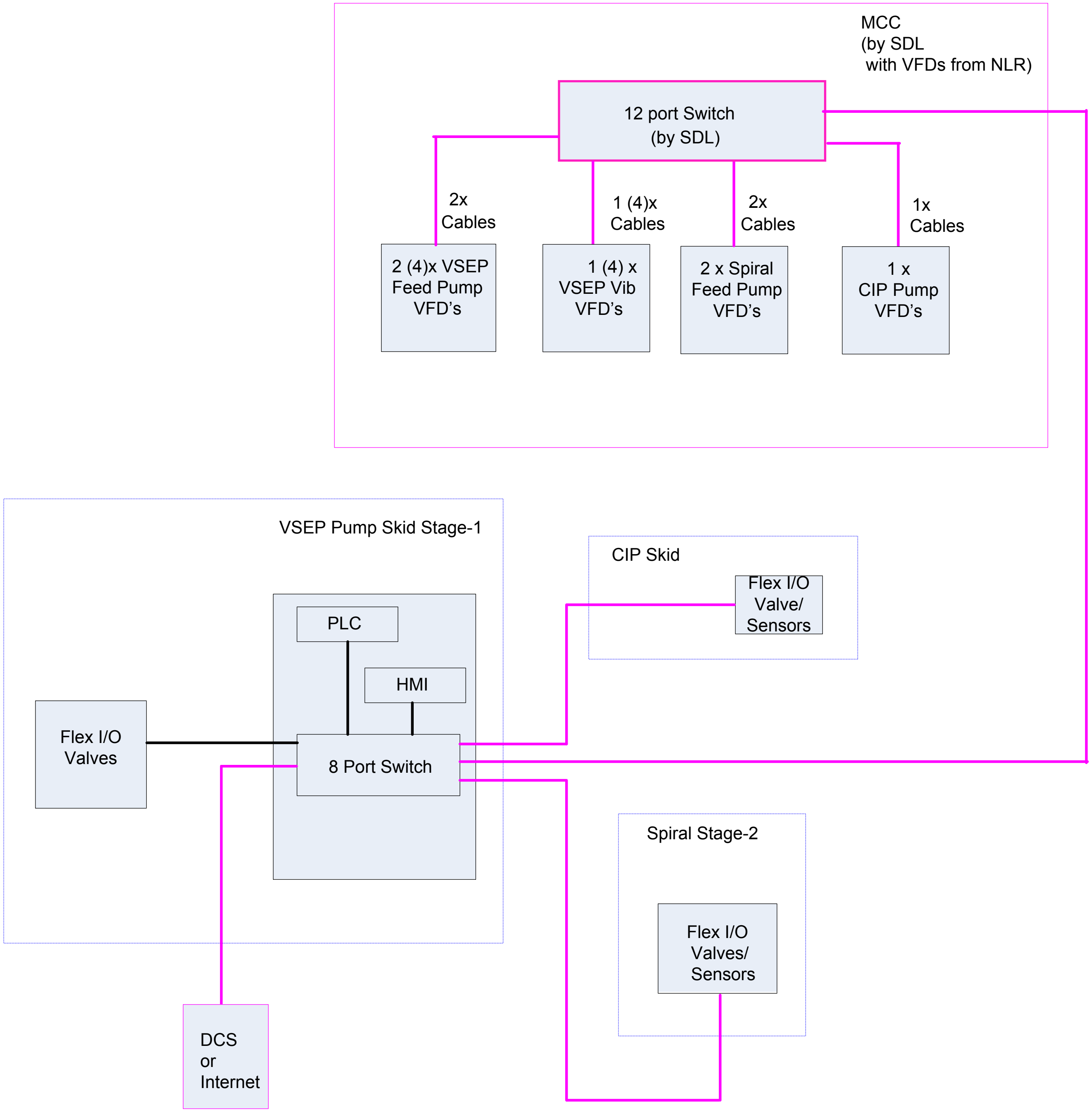
2. The location and type of any safety disconnect switch should be determined. (Provided by others)

3. Line Reactor/Filters provided by others.

4. Load Distribution Panels and Circuit Breakers provided by others.

5. Pre-Assembled Drive packages are not included. New Logic will provide AC Tech only.

6. Modern managed Ethernet switch provided by client, with the ability to set ports. Ports with cables going to all VFDs (which do not support auto negotiate) need to be set as “auto negotiate” off and also as “full duplex” on, and all other Ethernet ports back to all other Allen Bradley equipment can be set to “auto negotiate” on and they will auto set to full duplex on.



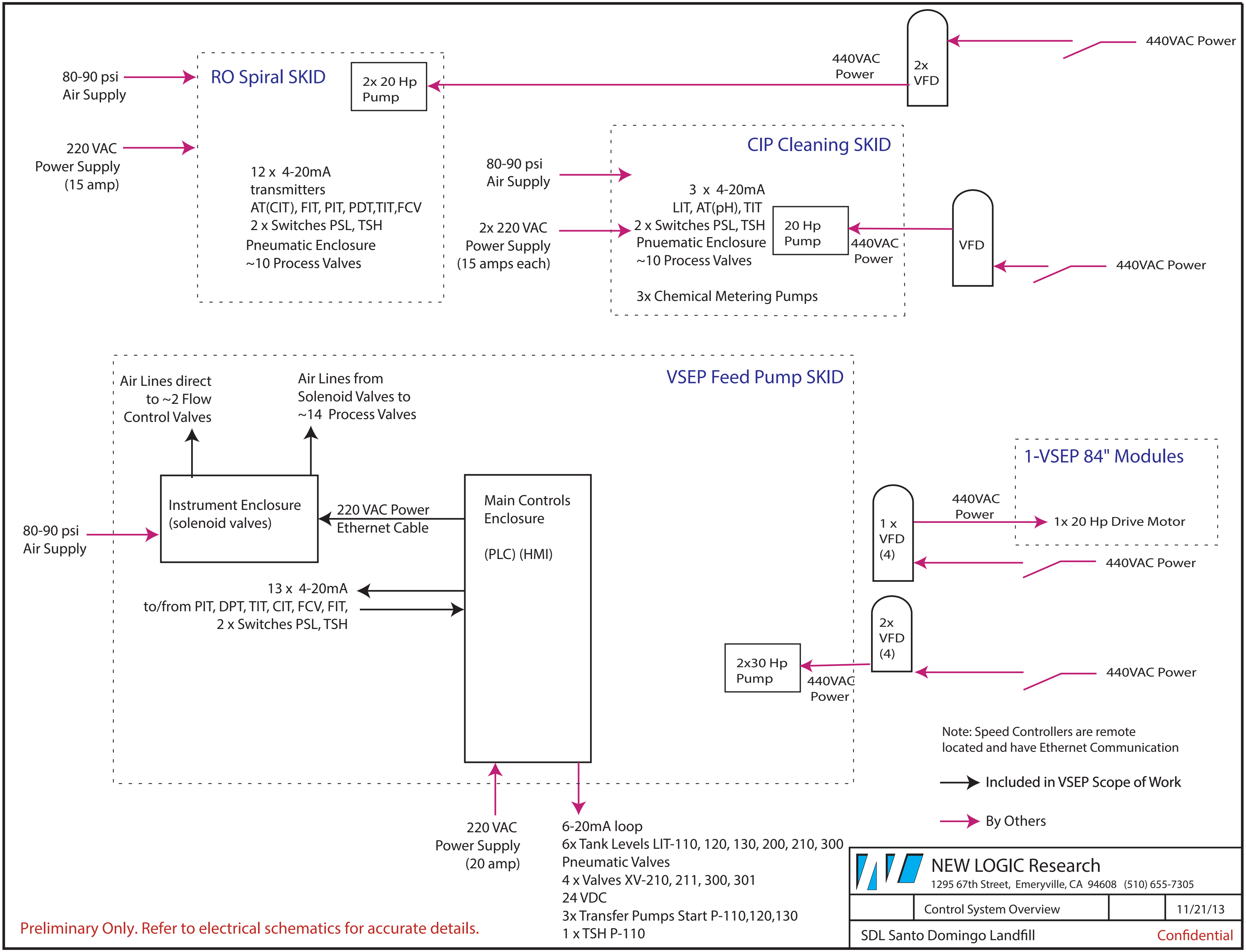
Note: NLR Recomends that customer supply modern Managed Switches with the ability to set ports. Ports with cables going to all VFDs (which do not support auto negotiate)need to be set as "auto negotiate" OFF and also as "full duplex" ON, and then all other Ethernet ports back to all other Allen Bradley equipment can be set to "auto negotiate" ON and they will auto set to full duplex ON.
For the Ethernet Cable we are specifying simple CAT5e UTP.
We have, so far, never needed shielded cable. We are more concerned about ground loops than we are about electrical noise.
If the customer feels that there is a compelling reason to use shielded cable, it is critical that shield grounds be connected properly.The cables must be grounded on 1 end only.
The cables must not be grounded at the VFDs. The cables should not be grounded at the processor.

ENET Supplied by customer

ENET Supplied by NLR

Preliminary Only.

New Logic Research Inc.	21 Nov 2013
SDL Santo Domingo	Ver A
Network Diagram	**G. Delly**



RO Spiral SKID
80-90 psi
Air Supply
220 VAC
Power Supply
(15 amp)
2x 20 Hp
Pump
12 x 4-20mA
transmitters
AT(CIT), FIT, PIT, PDT,TIT,FCV
2 x Switches PSL, TSH
Pneumatic Enclosure
~10 Process Valves
440VAC
Power
2x
VFD
440VAC Power
CIP Cleaning SKID
80-90 psi
Air Supply
2x 220 VAC
Power Supply
(15 amps each)
3 x 4-20mA
LIT, AT(pH), TIT
2 x Switches PSL, TSH
Pnuematic Enclosure
~10 Process Valves
20 Hp
Pump
440VAC
Power
VFD
440VAC Power
3x Chemical Metering Pumps
VSEP Feed Pump SKID
Air Lines direct
to ~2 Flow
Control Valves
Air Lines from
Solenoid Valves to
~14 Process Valves
80-90 psi
Air Supply
Instrument Enclosure
(solenoid valves)
220 VAC Power
Ethernet Cable
Main Controls
Enclosure
(PLC) (HMI)
13 x 4-20mA
to/from PIT, DPT, TIT, CIT, FCV, FIT,
2 x Switches PSL, TSH
1-VSEP 84" Modules
1 x
VFD
(4)
440VAC
Power
1x 20 Hp Drive Motor
440VAC Power
2x
VFD
(4)
2x30 Hp
Pump
440VAC
Power
440VAC Power
Note: Speed Controllers are remote
located and have Ethernet Communication
Included in VSEP Scope of Work
By Others
220 VAC
Power Supply
(20 amp)
6-20mA loop
6x Tank Levels LIT-110, 120, 130, 200, 210, 300
Pneumatic Valves
4 x Valves XV-210, 211, 300, 301
24 VDC
3x Transfer Pumps Start P-110,120,130
1 x TSH P-110
Preliminary Only. Refer to electrical schematics for accurate details.
NEW LOGIC Research
1295 67th Street, Emeryville, CA 94608 (510) 655-7305
Control System Overview
11/21/13
SDL Santo Domingo Landfill
Confidential

SMV Series Ratings & Dimensions

Vibration Drive VFD	ESV153N04TXD	x1
Feed Pump Drive VFDs	ESV233E04TXD	x2
CIP Pump Drive VFDs	ESV153N04TXD	x1
Spiral Pump Drives VFDs	ESV153N04TXD	x2

HP	kW	Voltage Input	Phase	3 Phase Output Amps	3 Phase Mains Amps	CB/ FUSE SIZING	NEMA 4 Model Number	Dims
20	15.00	480/400	3Ø	27/31	31/35	40	ESV153E04TXD	9.42x14.38x9.45"
25	18.75	480/400	3Ø	34/39	38/44	50	ESV233E04TXD	9.42x14.38x9.45"

400...480VAC Models

400 ... 480V Three Phase (3/PE) (400V: 340...440V), (480V: 340...528V); 48...62Hz											
Type	Power		Mains Current		Output Current				Heat Loss (Watts)		
	Hp	kW	400V A	480V A	Cont (I_n) A		Max I %		N1/IP31	N4X/IP65 No filter	N4X/IP65 W/ filter
					400V	480V	400V	480V			
ESV371--4T--	0.5	0.37	1.7	1.5	1.3	1.1	175	200	23	21	25
ESV751--4T--	1	0.75	2.9	2.5	2.4	2.1	175	200	37	33	37
ESV112--4T--	1.5	1.1	4.2	3.6	3.5	3.0	175	200	48	42	46
ESV152--4T--	2	1.5	4.7	4.1	4.0	3.5	175	200	57	50	54
ESV222--4T--	3	2.2	6.1	5.4	5.5	4.8	175	200	87	78	82
ESV302--4T--	4	3.0	8.3	7.0	7.6	6.3	175	200			95
ESV402--4T--	5	4.0	10.6	9.3	9.4	8.2	175	200	128	103	111
ESV552--4T--	7.5	5.5	14.2	12.4	12.6	11.0	175	200	178	157	165
ESV752--4T--	10	7.5	18.1	15.8	16.1	14.0	175	200	208	190	198
ESV113--4T--	15	11	27	24	24	21	155	180	418	388	398
ESV153--4T--	20	15	35	31	31	27	155	180	493	449	459
ESV183--4T--	25	18.5	44	38	39	34	155	180	645	589	600
ESV223--4T--	30	22	52	45	46	40	155	180	709	637	647

NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0
For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1

Type		Recommendations				
		Fuse	Miniature circuit breaker(1)	Fuse (2) or Breaker(3) (N. America)	Input Power Wiring (L1, L2, L3, PE) [mm²]	[AWG]
400V or 480V 3~(3/PE)	ESV371N04TXB ...ESV222N04TXB ESV371N04T_* ...ESV222N04T_* ESV371N04TF* ...ESV222N04TF*	M10 A	C10 A	10 A	1.5	14
	ESV302N04T_*	M16 A	C16 A	15 A	2.5	14
	ESV402N04TXB, ESV402N04T_*	M16 A	C16 A	20 A	2.5	14
	ESV552N04TXB, ESV552N04T_*	M20 A	C20 A	20 A	2.5	14
	ESV752N04TXB, ESV752N04T_~	M25 A	C25 A	25 A	4.0	10
400V or 480V 3~(3/PE)	ESV113N04TXB, ESV113N04T_~	M40 A	C40 A	40 A	4	8
	ESV153N04TXB, ESV153N04T_~	M50 A	C50 A	50 A	10	8
	ESV183N04TXB, ESV183N04T_~	M63 A	C63A	70 A	10	6
	ESV223N04TXB, ESV223N04T_~	M80 A	C80 A	80 A	16	6

2.2 SMV Type Number Designation

The table herein describes the Type numbering designation for the SMVector Inverter models.

ESV	152	N0	2	T	X	B

Electrical Products in the SMVector Series

Power Rating in kW:

- 251 = 0.25kW (0.33HP)
- 371 = 0.37kW (0.5HP)
- 751 = 0.75kW (1HP)
- 112 = 1.1kW (1.5HP)
- 152 = 1.5kW (2HP)
- 222 = 2.2kW (3HP)
- 302 = 3.0kW (4HP)
- 402 = 4.0kW (5HP)
- 552 = 5.5kW (7.5HP)
- 752 = 7.5kW (10HP)
- 113 = 11.0kW (15HP)
- 153 = 15.0kW (20HP)
- 183 = 18.5kW (25HP)
- 223 = 22.0kW (30HP)

Installed I/O & Communication Module(s):

- C_ = CANopen (Available all models)
- D_ = DeviceNet (Available all models)
- E_ = Ethernet/IP, ModBus TCP/IP (Avail all models)
- R_ = RS-485 / ModBus /Lecom (Avail all models)
- P_ = ProfiBus-DP (Available all models)
- N_ = No Communications installed (Non-IP20)

The "_" blank can be:
0 = Standard Keypad
N = No Keypad (NEMA 4X / IP65 only)

Input Voltage:

- 1 = 120 VAC (doubler output) or 240 VAC
- 2 = 240 VAC
- 4 = 400/480 VAC
- 6 = 600 VAC

Input Phase:

- S = Single Phase Input only
- Y = Single or Three Phase Input
- T = Three Phase Input only

Input Line Filter

- F = Integral EMC Filter
- L = Integral EMC Filter and Integrated Line Disconnect (NEMA 4X/IP65 Models only)
- M = Integrated Line Disconnect (NEMA 4X/IP65 Models only)
- X = No EMC Filter/No Line Disconnect

Enclosure:

- B = NEMA 1/IP31; Indoor only
- C = NEMA 4X/IP65; Indoor only; Convection cooled
- D = NEMA 4X/IP65; Indoor only; Fan cooled
- E = NEMA 4X/IP65; Indoor/Outdoor; Convection cooled
- F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled

NOTE
Prior to installation make sure the enclosure is suitable for the end-use environment
Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminates, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).

SMVector NEMA4X | Washdown Duty Inverter

Lenze AC Tech

RoHS COMPLIANT

World Class Control

Modes of Operation
- Open Loop Flux Vector, Speed or Torque Control
- V/Hz (Constant or Variable)
- Base Frequency Adjustable to Motor Specs
- Enhanced V/Hz with Auto-tuning

Acceleration/Deceleration Profiles
- Two Independent Accel Ramps
- Two Independent Decel Ramps
- Linear, S-Type
- Auxiliary Ramp(or Coast)-to-Stop

Fixed Accel Boost for Improved Starting

500 Hz Output Frequency

High Carrier PWM Sine-Coded Frequency
- 4, 6, 8, 10 or 12 kHz

Universal Logic Assertion (Selectable)
- Positive or Negative Logic Input
- Digital Reference Available

Braking Functions
- DC Injection Braking
- Optional Dynamic Braking

Speed Commands
- Keypad, Potentiometer
- Jog, 8 Preset Speeds
- Floating Point Control
- Voltage: Scalable 0 –10 VDC
- Current: Scalable 4 – 20 mA

Process Control
- PID Modes: Direct and Reverse Acting
- PID Sleep Mode
- Analog Output (Speed, Load, Torque, kW)
- Network Speed (Baud Rate)
- Terminal and Keypad Status
- Elapsed Run or Power On Time (Hours)

Status Outputs
- Programmable Form "A" Relay Output
- Programmable Open Collector Output
- Scalable 0-10 VDC / 2-10 VDC Analog Output

Run Screen Display
- Multiplier: 4-20mA w/500 Ohm Total Impedance

Environment

Ambient Temperature
- -10 to 55°C @ 6 kHz
- Derate 2.5% per °C Above 40°C

Comprehensive Diagnostic Tools

Real Time Monitoring
- 8 Register Fault History
- Software Version
- Drive Network ID
- DC Bus Voltage (V)
- Motor Voltage (V)
- Output Current (%)
- Motor Current (A)
- Motor Torque (%)
- Power (kW)
- Energy Consumption (kWh)
- Heatsink Temperature (°C)
- 0 – 10 VDC Input (User Defined)
- 4 – 20 mA Input (User Defined)
- PID Feedback (User Defined)

Vigilant System Protection

Voltage Monitoring
- Low and High DC Bus V Protection
- Low Line V Compensation
- Parameters can be reset for 50 or 60 Hz Motors

Current Monitoring
- Motor Overload Protection
- Current Limiting Safeguard
- Ground Fault
- Short Circuit Protection

Three ReStarts
- Two Flying and One Auto
- Password Protected

Loss of Follower Management
- Protective Fault
- Go to Preset Speed or Preset Setpoint
- Initiate System Notification

Over Temperature Protection

International Voltages

- +10/-15% Tolerance
- 120/240V, 1Ø
- 200/240V, 1 or 3Ø
- 200/240V, 3Ø
- 400/480V, 3Ø
- 480/600V, 3Ø

Global Standards

UL	GOST
cUL	C-Tick

- CE Low Voltage (EN61800-5-1)
- CE EMC (EN61800-3) with optional EMC filter

Keypad & Display

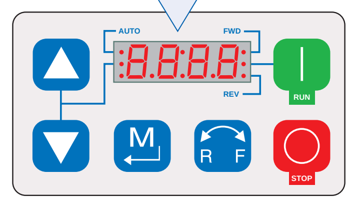
Simple Six Button Programming
- Start
- Stop
- Forward/Reverse
- Scroll Up
- Scroll Down
- Enter/Mode

Informative LED Display

Vivid Illumination
- Easily Read from a Distance

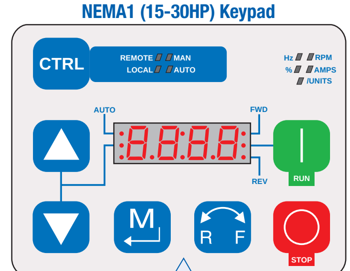
Five Status LEDs
- Run
- Automatic Speed mode
- Manual Speed Mode
- Forward Rotation
- Reverse Rotation

Status Display
- Motor Status
- Fault Management
- Operational Information



NEMA1 (Up to 10HP) Keypad

NEMA1 (15-30HP) Keypad



Additional CTRL Button

Switch between control modes
- Local-Manual
- Remote-Manual
- Local Auto
- Remote Auto

Additional LED Indicators

Define the units being displayed
- Hz
- RPM
- %
- Amps
- /Units

Control Terminals

Digital Inputs
- Dedicated Start/Stop
- (3) Programmable

Digital Outputs
- Form "A" Relay
- Open Collector

Analog Inputs
- 0 - 10 VDC
- 4 - 20 mA

Analog Outputs
- 0 - 10 VDC
- 2 - 10 VDC

Power Supplies
- 10 VDC Potentiometer Ref
- 12 VDC, 20 mA DI Ref or 0VDC Com
- 12 VDC, 50 mA Supply

Common

Additional Control Terminals (15 HP & up)

1 Programmable Digital Input
1 Common
RS-485 Modbus Communications
- TXA
- TXB

SMVector NEMA4X | Washdown Duty Inverter

Ratings

120/240V* - 1Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C] / Outdoor [E]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	2.4	ESV371N01SX[C] or [E]	R1	ESV371N01SMC	AA1
1	0.75	4.2	ESV751N01SX[C] or [E]	R1	ESV751N01SMC	AA1
1.5	1.1	6.0	ESV112N01SX[C] or [E]	R2	ESV112N01SMC	AA2

*Output voltage will be twice line voltage when connected to a 120V source. Output voltage will not exceed line voltage when connected to a 240V source.

200/240V - 1 or 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C] / Outdoor [E]*		NEMA4X w/Disconnect Indoor**	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	2.4	ESV371N02YX[C] or [E]	R1	ESV371N02YMC	AA1
1	0.75	4.2	ESV751N02YX[C] or [E]	R1	ESV751N02YMC	AA1
1.5	1.1	6.0	ESV112N02YX[C] or [E]	R2	ESV112N02YMC	AA2
2	1.5	7.0	ESV152N02YX[C] or [E]	R2	ESV152N02YMC	AA2
3	2.2	9.6	ESV222N02YX[C] or [E]	S1	ESV222N02YMC	AD1

*Filter versions are also available in 1-phase: Replace the "YX" in the Model Part Number with an "SF".
**Filter versions are also available in 1-phase: Replace the "YM" in the Model Part Number with an "SL".
***Model ESV251N02SXB is single-phase input only.

200/240V - 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
5	4	16.5	ESV402N02TX[C] or [E]	V1	ESV402N02TMC	AC1
7.5	5.5	23	ESV552N02TX[D] or [F]	T1	ESV552N02TMD	AB1
10	7.5	29	ESV752N02TX[D] or [F]	T1	ESV752N02TMD	AB1
15	11	42	ESV113N02TX[D] or [F]	W1	ESV113N02TMD	AF1
20	15	54	ESV153N02TX[D] or [F]	W1	ESV153N02TMD	AF1

400/480V - 3Ø Input (3Ø Output)

Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]*		NEMA4X w/Disconnect Indoor**	
Hp	kW	I_N [A]	Model	Size	Model	Size
0.5	0.37	1.3/1.1	ESV371N04TX[C] or [E]	R1	ESV371N04TMC	AA1
1	0.75	2.4/2.1	ESV751N04TX[C] or [E]	R1	ESV751N04TMC	AA1
1.5	1.1	3.5/3.0	ESV112N04TX[C] or [E]	R2	ESV112N04TMC	AA2
2	1.5	4.0/3.5	ESV152N04TX[C] or [E]	R2	ESV152N04TMC	AA2
3	2.2	5.5/4.8	ESV222N04TX[C] or [E]	R2	ESV222N04TMC	AA2
4	3.0	7.6/6.3	ESV302N04TX[C] or [E]	R2	ESV302N04TMC	AA2
5	4	9.4/8.2	ESV402N04TX[C] or [E]	V1	ESV402N04TMC	AC1
7.5	5.5	12.6/11	ESV552N04TX[C] or [E]	V1	ESV552N04TMC	AC1
10	7.5	16.1/14	ESV752N04TX[D] or [F]	T1	ESV752N04TMD	AB1
15	11	24/21	ESV113N04TX[D] or [F]	W1	ESV113N04TMD	AE1
20	15	31/27	ESV153N04TX[D] or [F]	W1	ESV153N04TMD	AE1
25	18.5	39/34	ESV183N04TX[D] or [F]	W1	ESV183N04TMD	AF1
30	22	46/40	ESV223N04TX[D] or [F]	X1	ESV223N04TMD	AF1

*Filter versions are also available in 1-phase: Replace the "X" in the Model Part Number with an "F".
**Filter versions are also available in 1-phase: Replace the "M" in the Model Part Number with an "L".

600V - 3Ø Input (3Ø Output)

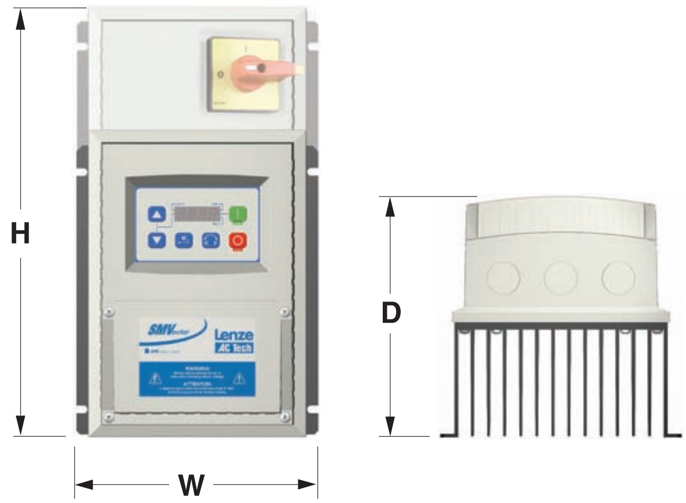
Power		Output Current	NEMA4X Indoor [C or D] / Outdoor [E or F]		NEMA4X w/Disconnect Indoor	
Hp	kW	I_N [A]	Model	Size	Model	Size
1	0.75	1.7	ESV751N06TX[C] or [E]	R1	ESV751N06TMC	AA1
2	1.5	2.7	ESV152N06TX[C] or [E]	R2	ESV152N06TMC	AA2
3	2.2	3.9	ESV222N06TX[C] or [E]	R2	ESV222N06TMC	AA2
5	4	6.1	ESV402N06TX[C] or [E]	V1	ESV402N06TMC	AC1
7.5	5.5	9	ESV552N06TX[C] or [E]	V1	ESV552N06TMC	AC1
10	7.5	11	ESV752N06TX[D] or [F]	T1	ESV752N06TMD	AB1
15	11	17	ESV113N06TX[D] or [F]	W1	ESV113N06TMD	AE1
20	15	22	ESV153N06TX[D] or [F]	W1	ESV153N06TMD	AE1
25	18.5	27	ESV183N06TX[D] or [F]	W1	ESV183N06TMD	AF1
30	22	32	ESV223N06TX[D] or [F]	X1	ESV223N06TMD	AF1

Dimensions

Dimensions

	H		W		D	
	in.	mm	in.	mm	in.	mm
R1	8.00	203	6.30	160	4.50	114
R2	8.00	203	6.30	160	6.30	160
S1	8.00	203	7.10	181	6.80	172
T1	10.00	254	8.10	204	8.00	203
V1	10.00	254	9.00	228	8.00	203
W1	14.40	366	9.40	240	9.50	241
X1	18.50	470	9.40	240	9.50	241
AA1 (4)	11.00	279	6.30	160	5.40	136
AA2 (4)	11.00	279	6.30	160	7.20	182
AB1 (4)	13.00	330	8.10	204	8.90	225
AC1 (4)	13.00	330	9.00	228	9.00	226
AD1 (4)	11.00	279	7.10	181	7.70	194
AE1 (4)	14.40	366	9.40	240	10.30	261
AF1 (4)	18.50	470	9.40	240	11.20	285

(4) The "D" (depth) dimension includes the disconnect switch.



Options

Communication Modules (Only one Communication module can be installed at a time.)	
Item Number	Item Description
ESVZAC0	CANopen Communications Interface Module
ESVZAR0	RS-485/Modbus Communications Interface Module
ESVZAP0	PROFIBUS DP Communications Interface Module
ESVZAD0	DeviceNet Communications Interface Module
ESVZAE0	EtherNet/IP Communications Interface Module
Keypad	
ESVZXK1	Remote Keypad w/ drive interface module & cable up to 10HP (7.5kW)
ESVZXH0	Remote Keypad w/ cable 15HP (11kW) and up
Additional I/O (cannot be used with Communication modules or Remote keypad ESVZXK1)	
ESVZAL0	Additional Form C Relay Output Module
ESVZAL1	Additional I/O Module w/ 1 Form C Relay Output and 2 Digital Inputs
Potentiometer	
ESVZXM1	NEMA 4X terminal cover with integral speed potentiometer (W = 6.3 or 7.1 in)
ESVZXM2	NEMA 4X terminal cover with integral speed potentiometer (W = 9.0 or 8.1 in)
ESVZXM3	NEMA 4X terminal cover with integral speed potentiometer (W = 9.4 in)

Dynamic Braking Modules with Built-in Resistors				
		Motor Voltage		
HP	(kW)	208 to 230 V Part Number	400 to 480 V Part Number	480 to 600 V Part Number
0.33 - 0.5	(0.25-0.37)	EZXDB3712A1	EZXDB3714A1	N/A
1 - 1.5	(0.75 - 1.1)	EZXDB1122A1	EZXDB1124A1	EZXDB1126A1
2 - 3	(1.5 - 2.2)	EZXDB2222A1	EZXDB2224A1	EZXDB2226A1
5	(4)	EZXDB4022A1	EZXDB4024A1	EZXDB4026A1
7.5	(5.5)	EZXDB5522A1	EZXDB5524A1	EZXDB5526A1
10	(7.5)	EZXDB7522A1	EZXDB7524A1	EZXDB7526A1
Dynamic Braking Modules without Built-in Resistors				
15 - 20	(11 - 15)	EZXDC1532A1	N/A	N/A
15 - 30	(11 - 22)	N/A	EZXDC2234A1	EZXDC2236A1
Open Dynamic Braking Resistors with mounting brackets				
15 - 20	(11 - 15)	841-009	841-009	841-010
25 - 30	(18.5 - 22)	N/A	841-011	841-012

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

CIRCUIT BREAKERS

IN MAIN ENCLOSURE:
CB0: Main Enclosure
CB1: PLC
CB2: Computer (HMI)
CB3: DC Power
CB4: PLC Digital I/O
CB5: Pump Seal Switch (TSH101, TSH103)
CB6: Power for Instrumentation Enclosure

IN CIP ENCLOSURE:
CB30: CIP Enclosure
CB31: Metering Pump Relays
CB32: Flex I/O 24 VDC Power Supply
CB33: Pump Seal Switch (TSH190)
CB34: Chemical Metering Pump Power

IN SPIRAL ENCLOSURE:
CB50: Spiral Enclosure
CB51: Digital I/O
CB52: Flex I/O 24VDC Power Supply
CB53: DC Power
CB54: Pump Seal Switch (TSH201)

FUSES

IN MAIN ENCLOSURE:
F1: 2A to VSEP #1 (PIT110, PIT111, PIT112)
F2: 2A to VSEP #1 (FIT111, FIT112)
F3: 2A to VSEP #2 (PIT120, PIT121, PIT122)
F4: 2A to VSEP #2 (FIT121, FIT122)
F5: 2A to VSEP #3 (PIT130, PIT131, PIT132)
F6: 2A to VSEP #3 (FIT131, FIT132)
F7: 2A to VSEP #4 (PIT140, PIT141, PIT142)
F8: 2A to VSEP #4 (FIT141, FIT142)
F9: 2A to Feed System (PIT100, TIT100, PDT100)
F10: 2A to VSEP System (AT100, AT101)
F11: 2A to Feed System (PDT101, AI1, AI2)
F12: 2A to External (LIT110, LIT120, LIT130)
F13: 2A to External (LIT200, LIT210, LIT300)
F14: 2A to Ethernet Switch, Air Supply Pressure Switch (PSL100)
F15: 2A to Pump Switch (TSH110)

IN SPIRAL ENCLOSURE:
F51: 2A to Spiral (PIT200, PIT201, PIT202)
F52: 2A to Spiral (PDT200, PDT201, TIT200)
F53: 2A to Spiral (FIT200, FIT201)
F54: 2A to Spiral (AT200, AT201)
F55: 2A to Flex I/O
F56: 2A to Air Supply Pressure Switch (PSL200)

NEW LOGIC RESEARCH

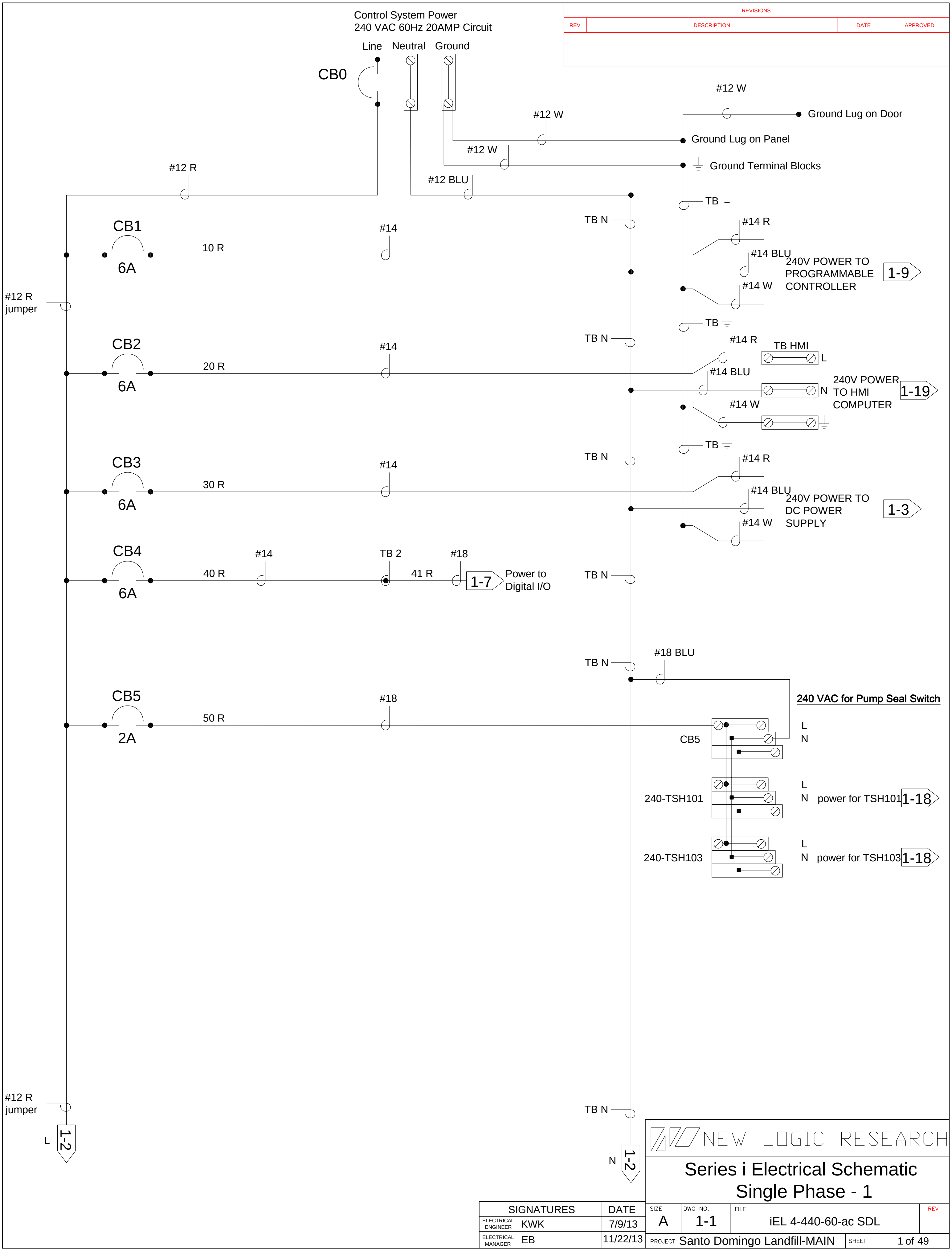
Series i Electrical Schematic
Enclosure Label

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-0	iEL 4-440-60-ac SDL	

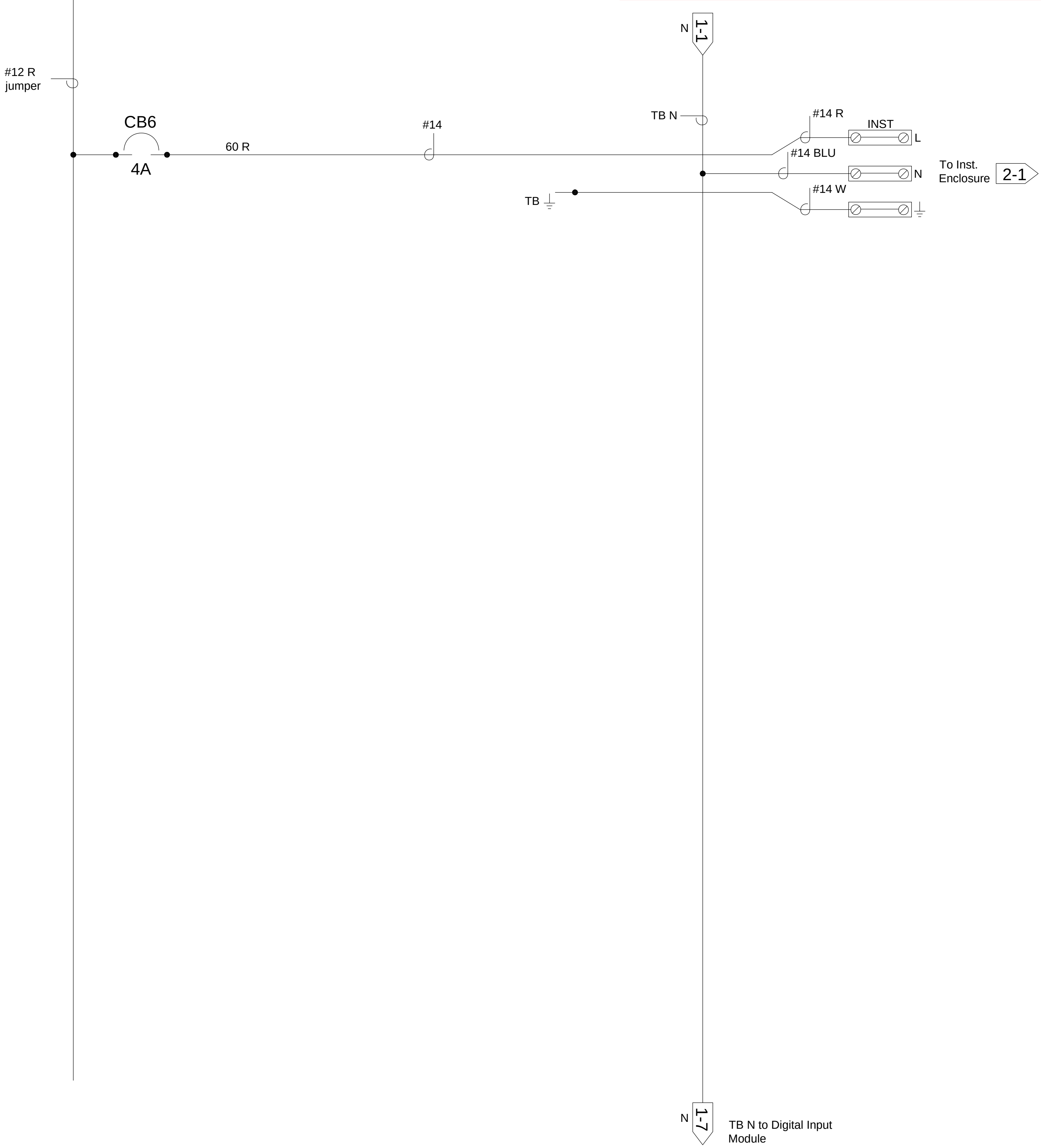
PROJECT: Santo Domingo Landfill-MAIN

SHEET 0 of 49



REVISIONS
REV
DESCRIPTION
DATE
APPROVED
Control System Power
240 VAC 60Hz 20AMP Circuit
Line
Neutral
Ground
CB0
#12 W
Ground Lug on Door
#12 W
Ground Lug on Panel
#12 W
Ground Terminal Blocks
#12 R
#12 BLU
TB
TB N
CB1
#14
10 R
6A
#14 R
#14 BLU
240V POWER TO
PROGRAMMABLE
CONTROLLER
1-9
#14 W
#12 R
jumper
TB
TB N
CB2
#14
20 R
6A
#14 R
TB HMI
L
#14 BLU
N
240V POWER
TO HMI
COMPUTER
1-19
#14 W
TB
TB N
CB3
#14
30 R
6A
#14 R
#14 BLU
240V POWER TO
DC POWER
SUPPLY
1-3
#14 W
CB4
#14
TB 2
#18
40 R
41 R
6A
1-7
Power to
Digital I/O
TB N
#18 BLU
TB N
240 VAC for Pump Seal Switch
CB5
#18
50 R
2A
L
N
CB5
L
N
240-TSH101
power for TSH101
1-18
L
N
240-TSH103
power for TSH103
1-18
#12 R
jumper
L
1-2
TB N
N
1-2
NEW LOGIC RESEARCH
Series i Electrical Schematic
Single Phase - 1
SIGNATURES
DATE
ELECTRICAL ENGINEER
KWK
7/9/13
ELECTRICAL MANAGER
EB
11/22/13
SIZE
A
DWG NO.
1-1
FILE
iEL 4-440-60-ac SDL
REV
PROJECT: Santo Domingo Landfill-MAIN
SHEET
1 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

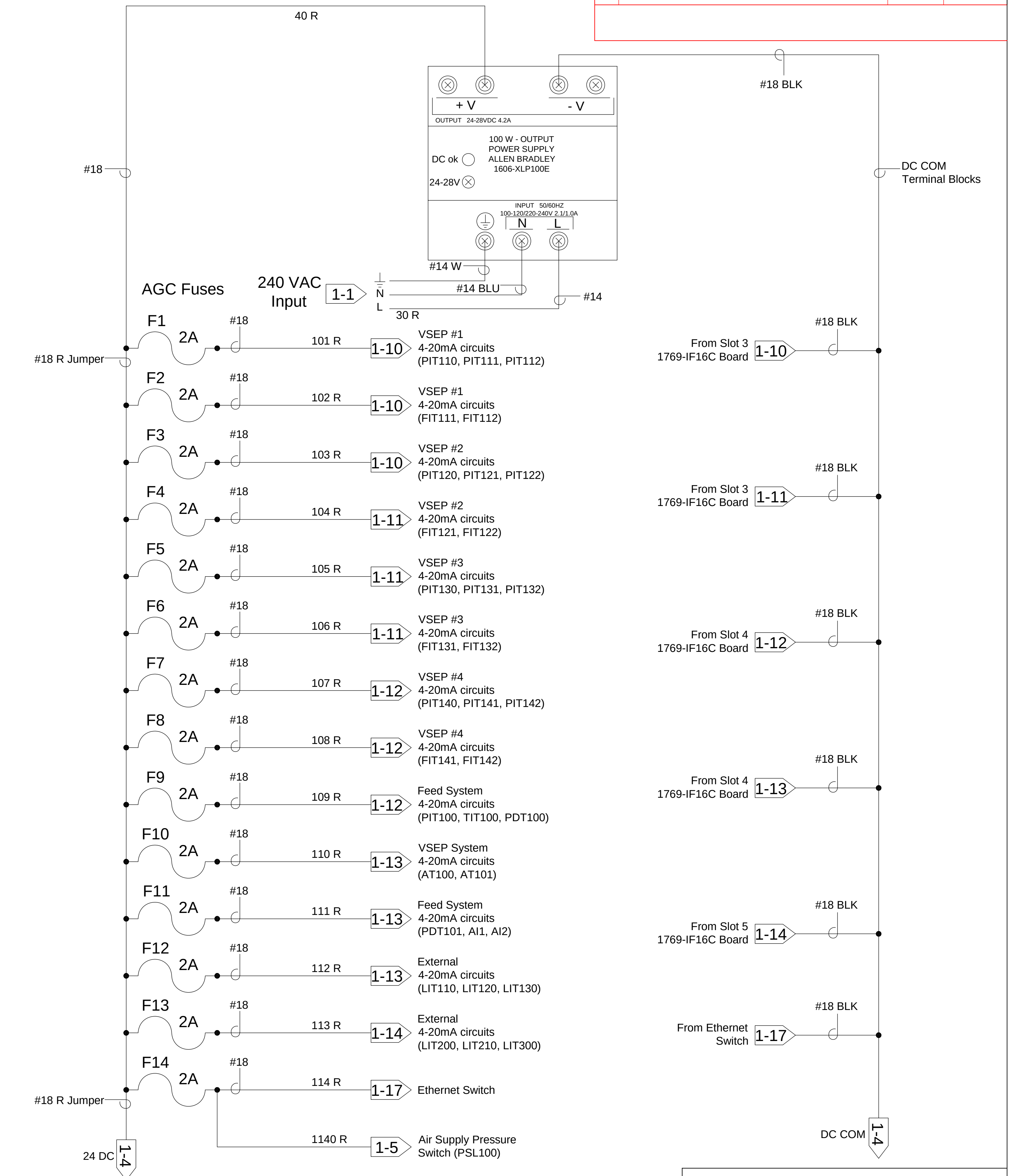
Series i Electrical Schematic
Single Phase - 2

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-2	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN — SHEET 2 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

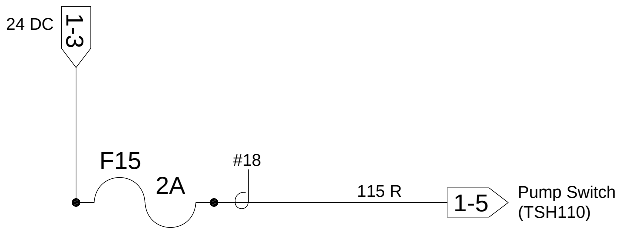
Series i Electrical Schematic
DC - 1

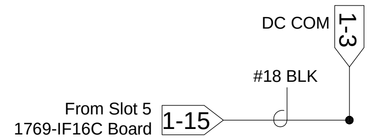
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN — SHEET 3 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED





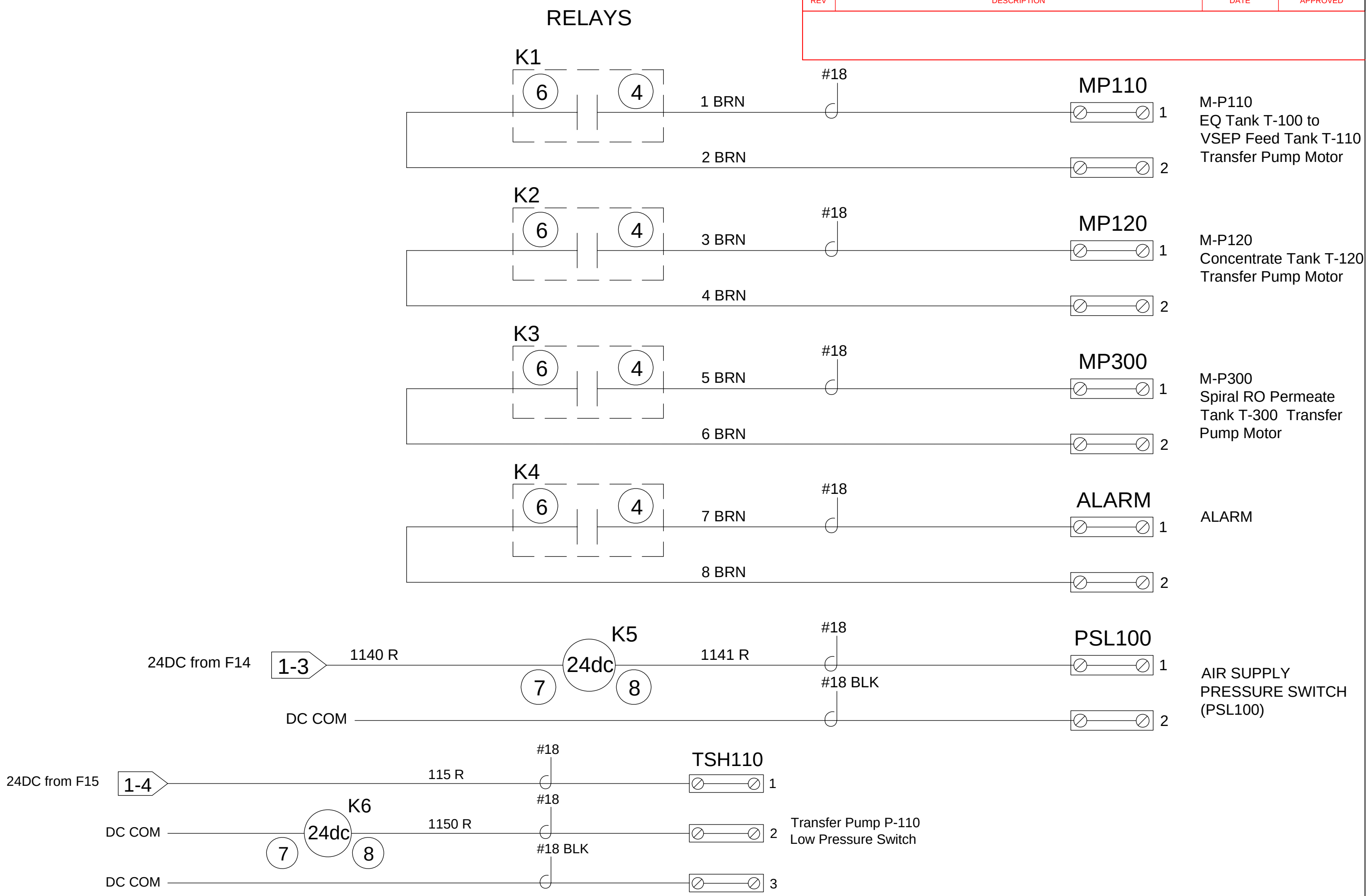
NEW LOGIC RESEARCH

Series i Electrical Schematic
DC - 2

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

SWITCH TRANSMITTER CONNECTION

Connect BRN to "1" terminal
Connect BLK to "2" terminal
Connect BLU to "3" terminal

NEW LOGIC RESEARCH

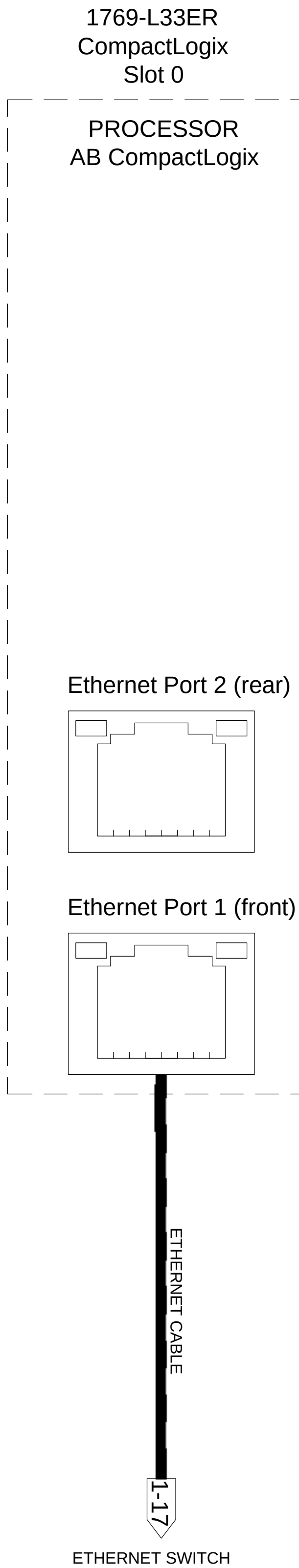
Series i Electrical Schematic
Relay

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-5	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN | SHEET 5 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

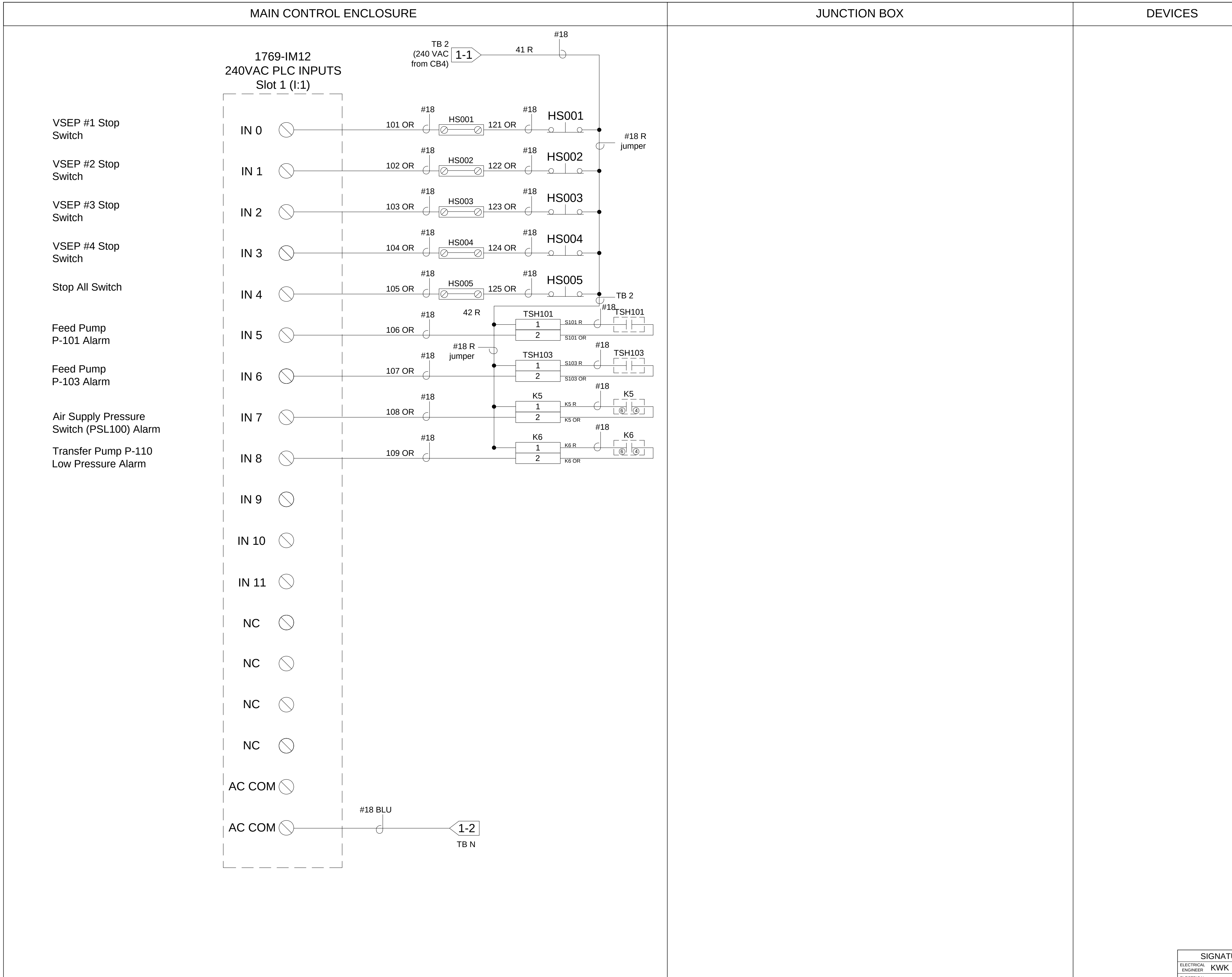


NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-6	iEL 4-440-60-ac SDL	
PROJECT: Santo Domingo Landfill-MAIN		SHEET	6 of 49



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

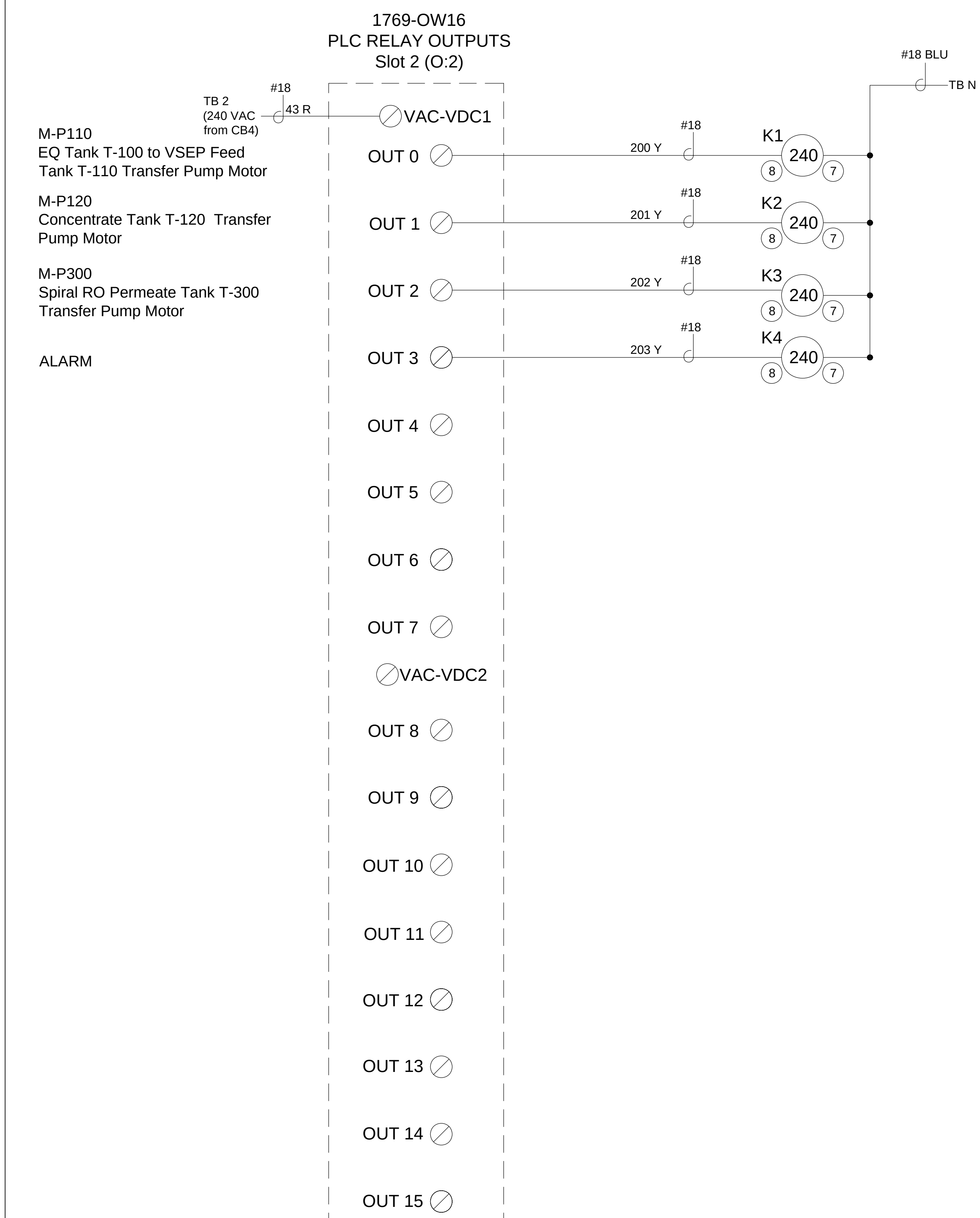
Series i Electrical Schematic
PLC_1DI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE A | DWG NO. 1-7 | FILE iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 7 of 49

MAIN CONTROL ENCLOSURE | JUNCTION BOX | DEVICES



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

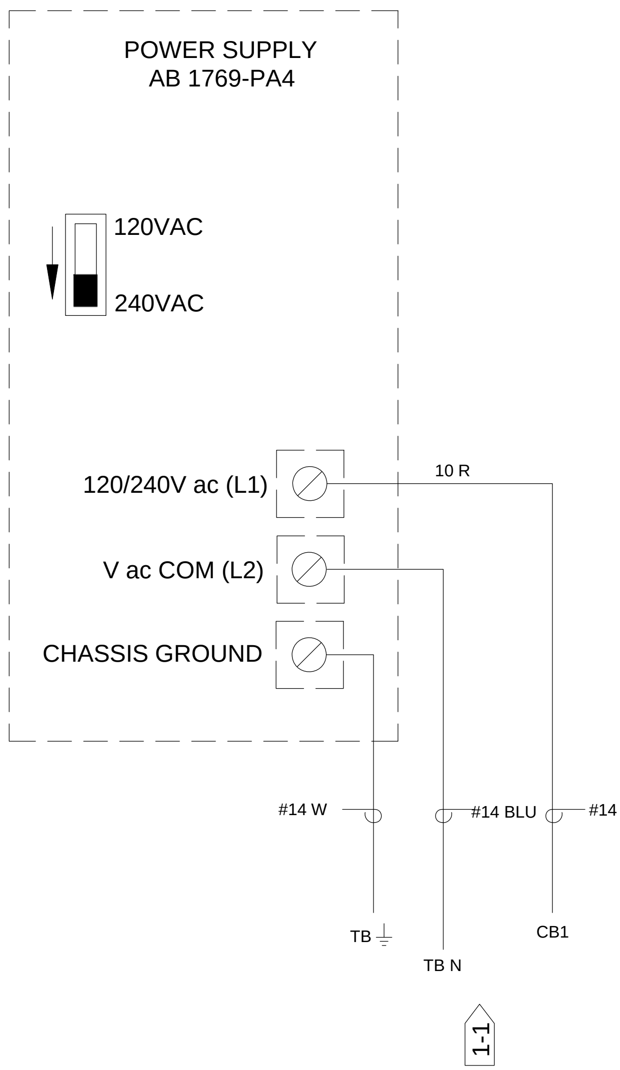
Series i Electrical Schematic
PLC_2RO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE: A | DWG NO.: 1-8 | FILE: iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-MAIN | SHEET 8 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



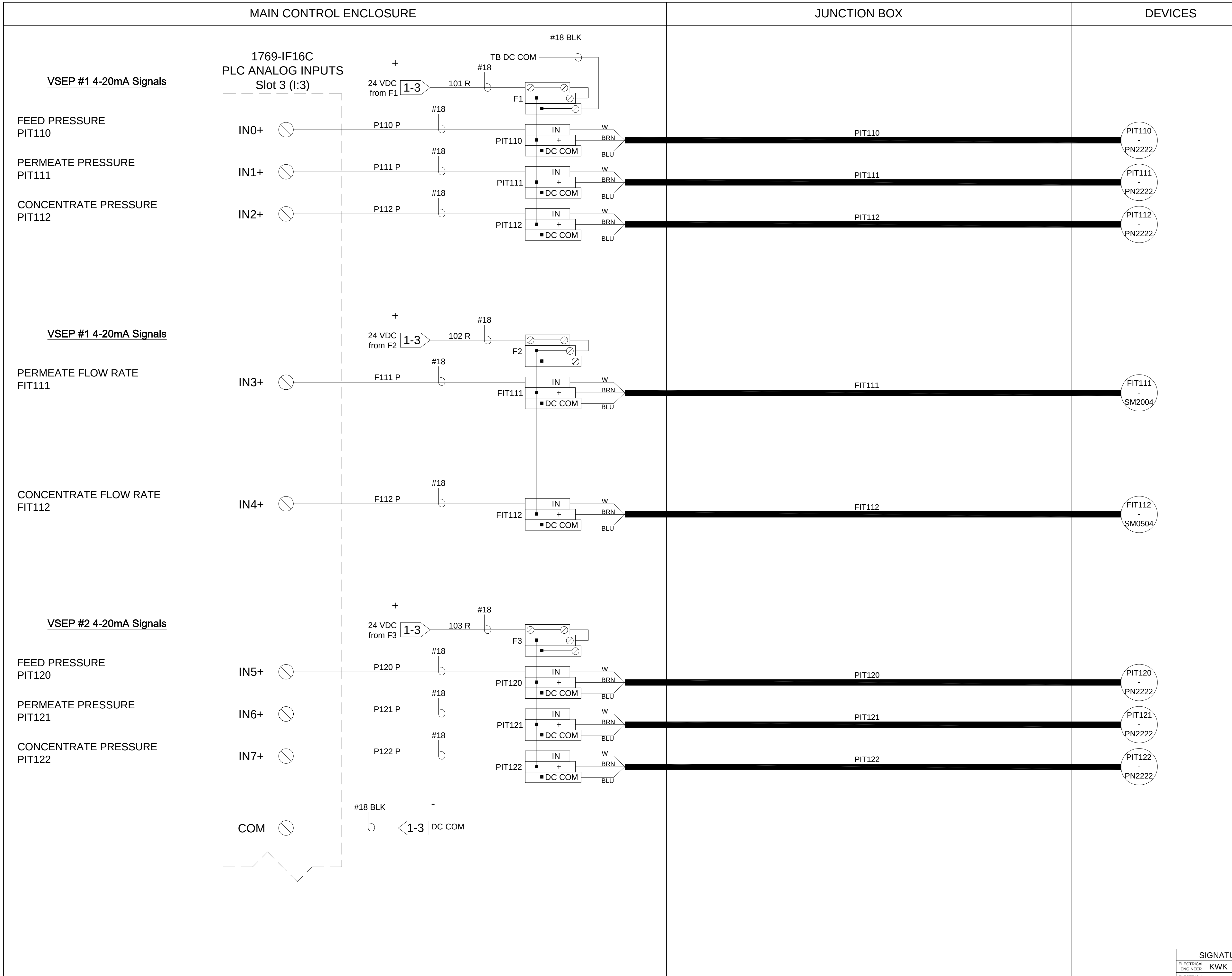
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_Power-Supply

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-9	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

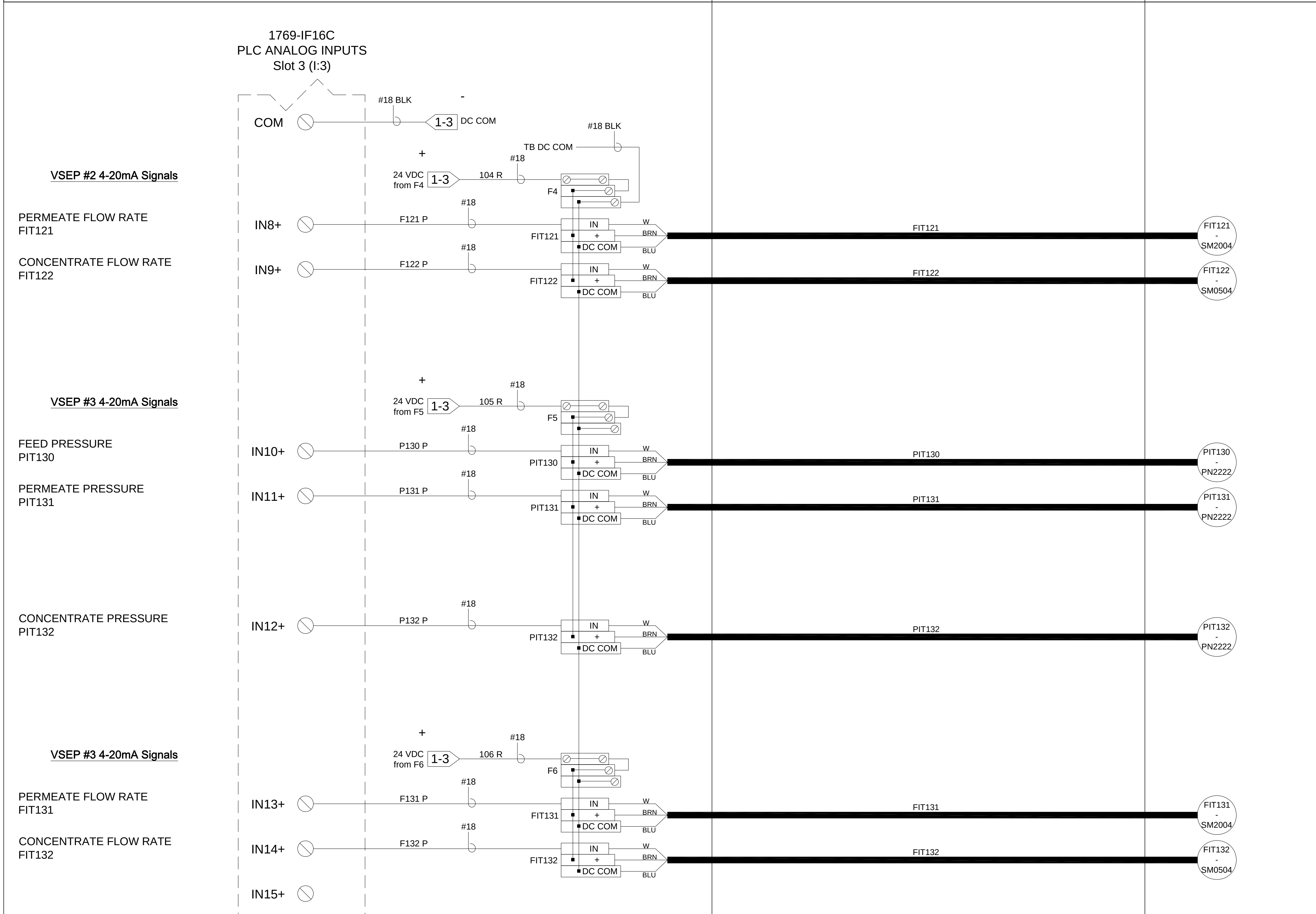
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_3aAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-10	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET	10 of 49

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



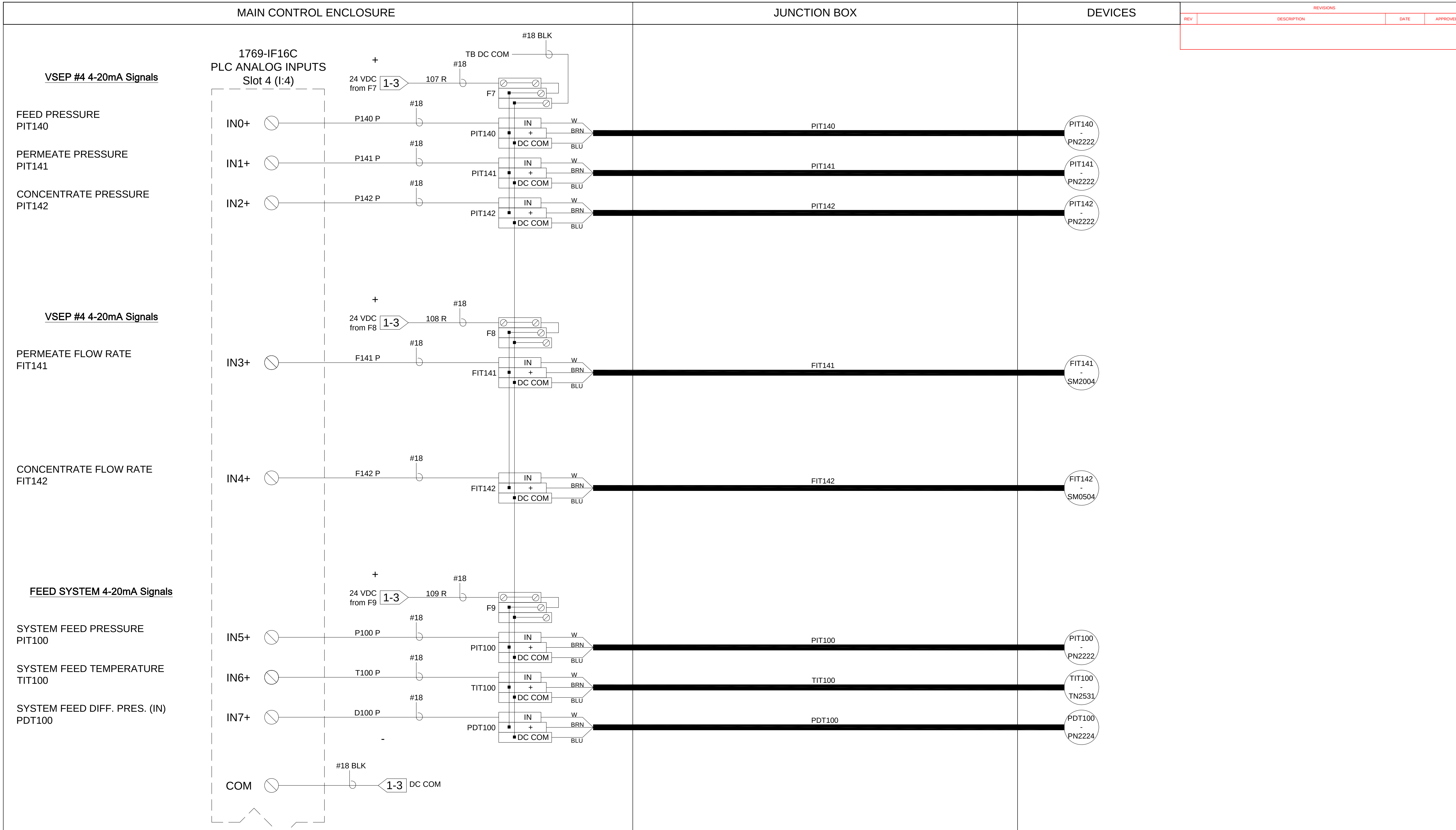
NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_3bAI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-11	iEL 4-440-60-ac SDL	

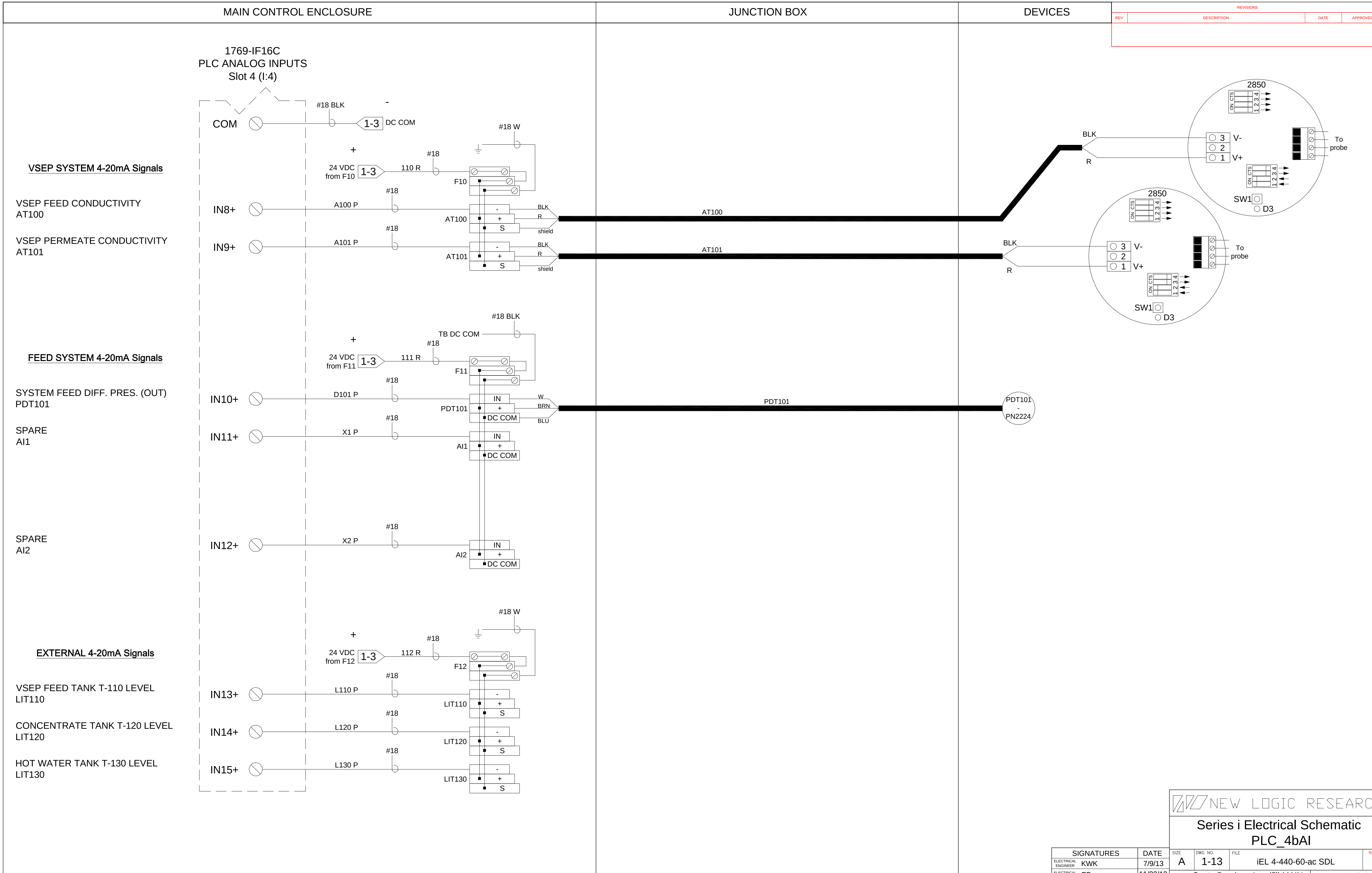
PROJECT: Santo Domingo Landfill-MAIN | SHEET 11 of 49



NEW LOGIC RESEARCH

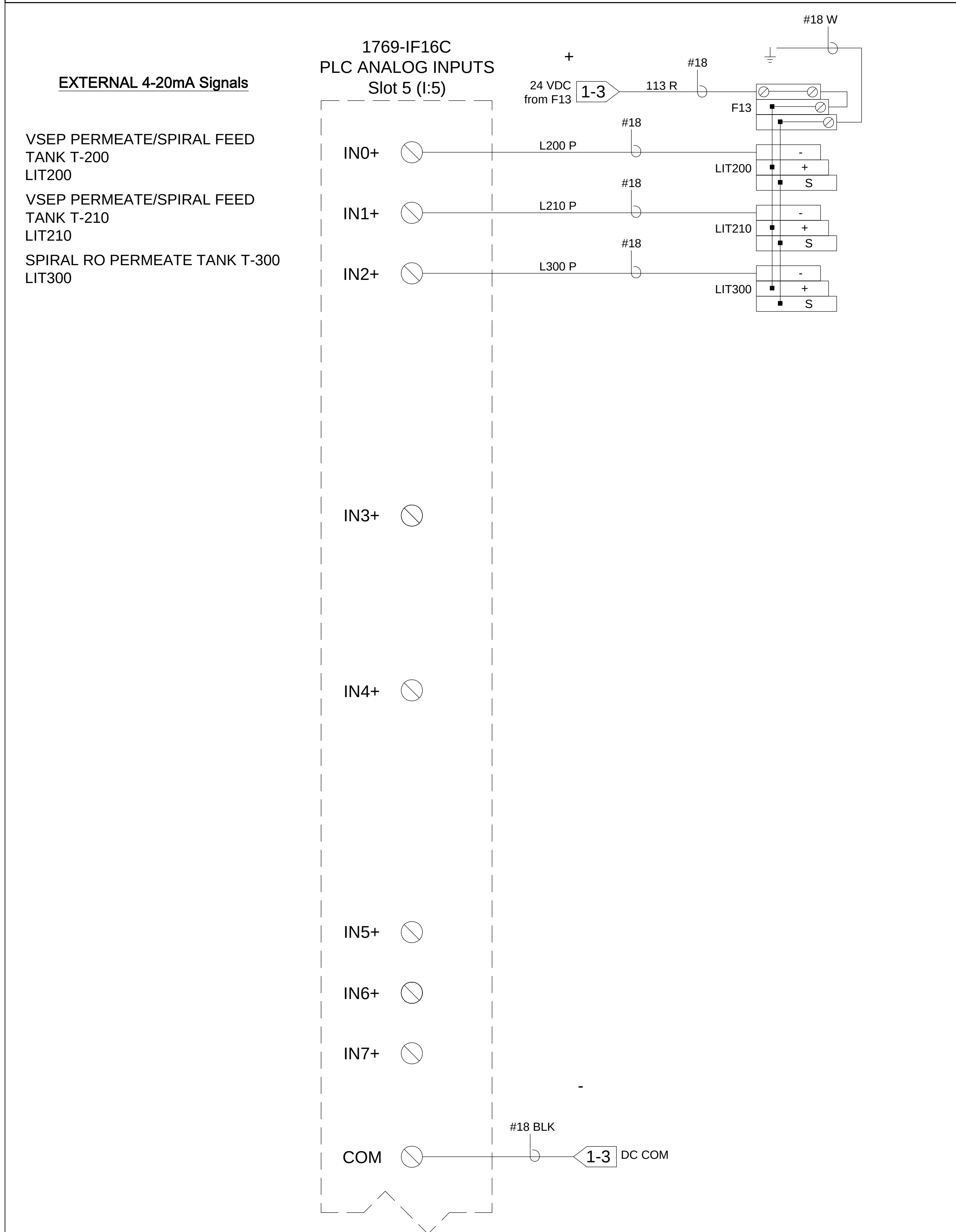
Series i Electrical Schematic
PLC_4aAI

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-12	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET 12 of 49	


MAIN CONTROL ENCLOSURE
JUNCTION BOX
DEVICES
REVISIONS
REV
DESCRIPTION
DATE
APPROVED
1769-IF16C
PLC ANALOG INPUTS
Slot 4 (I:4)
COM
#18 BLK
1-3 DC COM
#18 W
24 VDC from F10
1-3
110 R
#18
F10
VSEP SYSTEM 4-20mA Signals
VSEP FEED CONDUCTIVITY
AT100
IN8+
A100 P
AT100
BLK
R
shield
VSEP PERMEATE CONDUCTIVITY
AT101
IN9+
A101 P
AT101
2850
V-
V+
To probe
SW1
D3
FEED SYSTEM 4-20mA Signals
#18 BLK
TB DC COM
24 VDC from F11
111 R
F11
SYSTEM FEED DIFF. PRES. (OUT)
PDT101
IN10+
D101 P
IN
DC COM
W
BRN
BLU
PDT101
PDT101
-
PN2224
SPARE
AI1
IN11+
X1 P
AI1
SPARE
AI2
IN12+
X2 P
AI2
EXTERNAL 4-20mA Signals
24 VDC from F12
112 R
F12
VSEP FEED TANK T-110 LEVEL
LIT110
IN13+
L110 P
LIT110
CONCENTRATE TANK T-120 LEVEL
LIT120
IN14+
L120 P
LIT120
HOT WATER TANK T-130 LEVEL
LIT130
IN15+
L130 P
LIT130
NEW LOGIC RESEARCH
Series i Electrical Schematic
PLC_4bAI
SIGNATURES
DATE
ELECTRICAL ENGINEER KWK 7/9/13
ELECTRICAL MANAGER EB 11/22/13
SIZE A
DWG NO. 1-13
FILE iEL 4-440-60-ac SDL
REV
PROJECT: Santo Domingo Landfill-MAIN
SHEET 13 of 49

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_5aAI

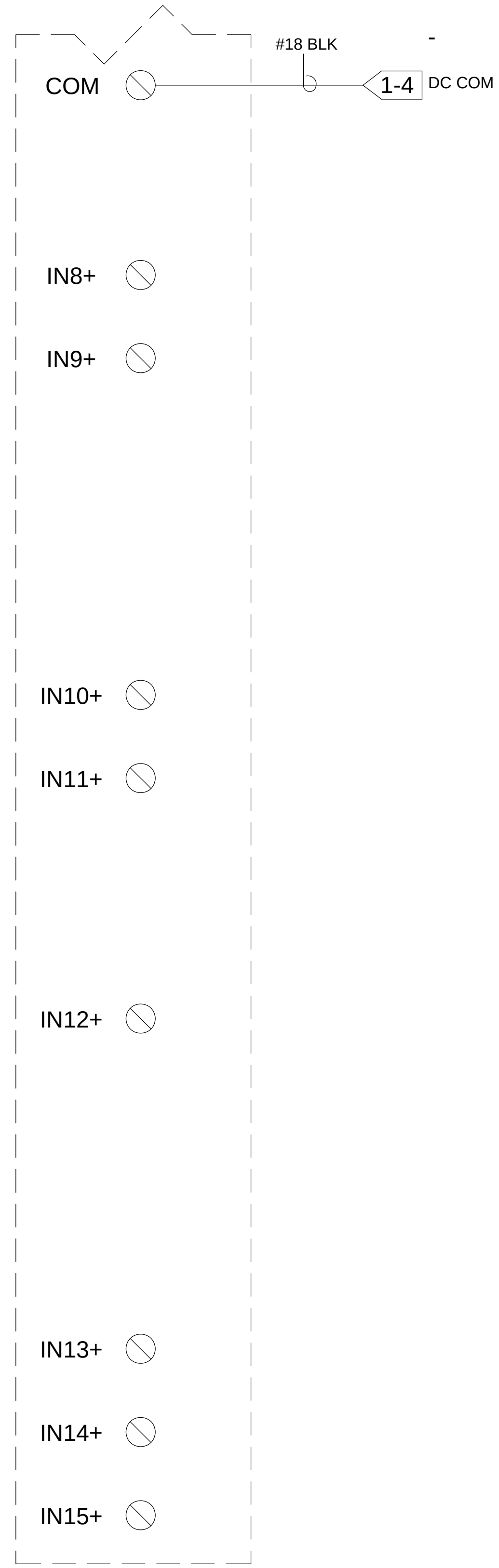
SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-14	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET	14 of 49

MAIN CONTROL ENCLOSURE	JUNCTION BOX	DEVICES

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

1769-IF16C
PLC ANALOG INPUTS
Slot 5 (I:5)



NEW LOGIC RESEARCH

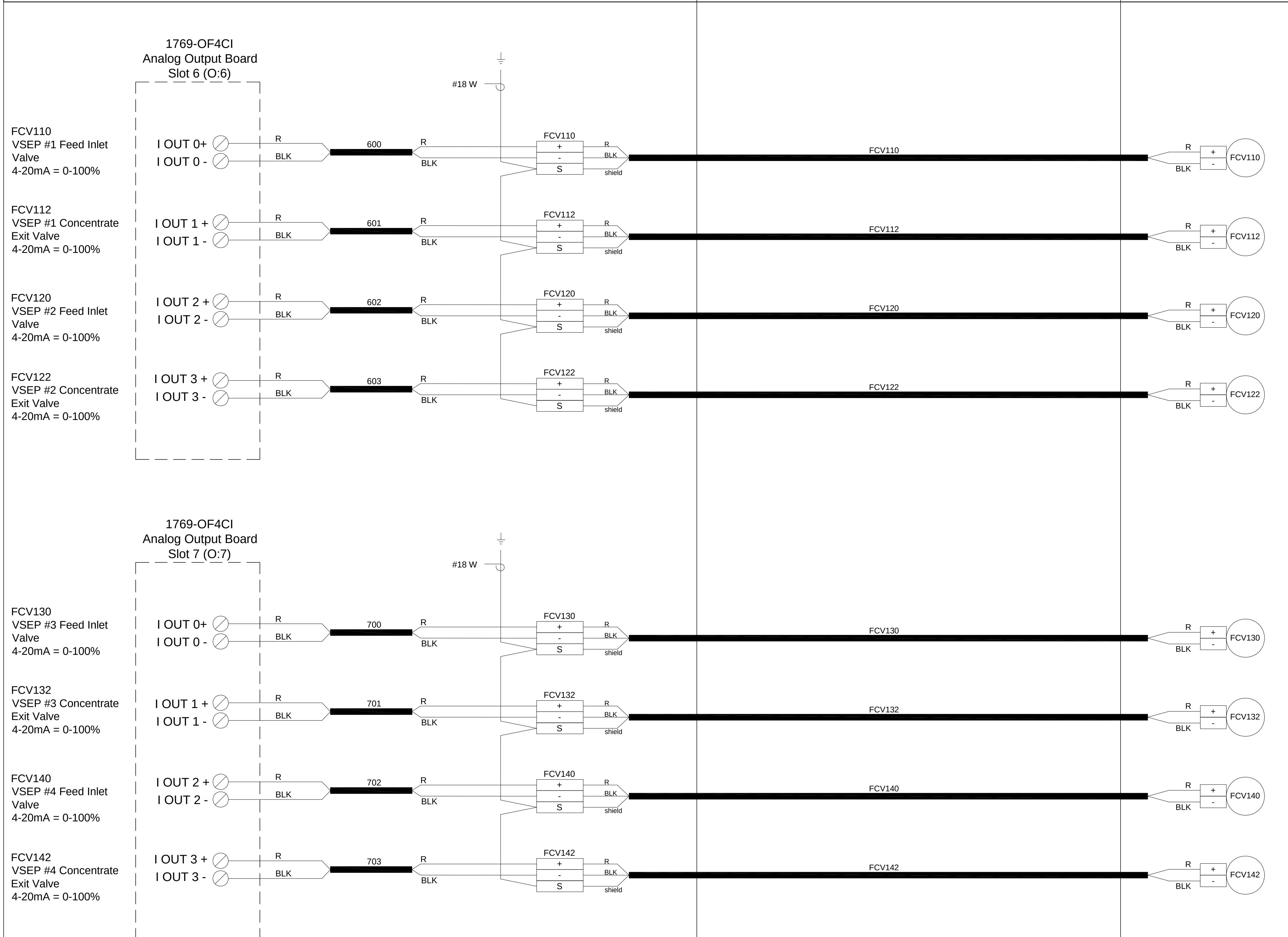
Series i Electrical Schematic
PLC_5bAI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-15	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 15 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



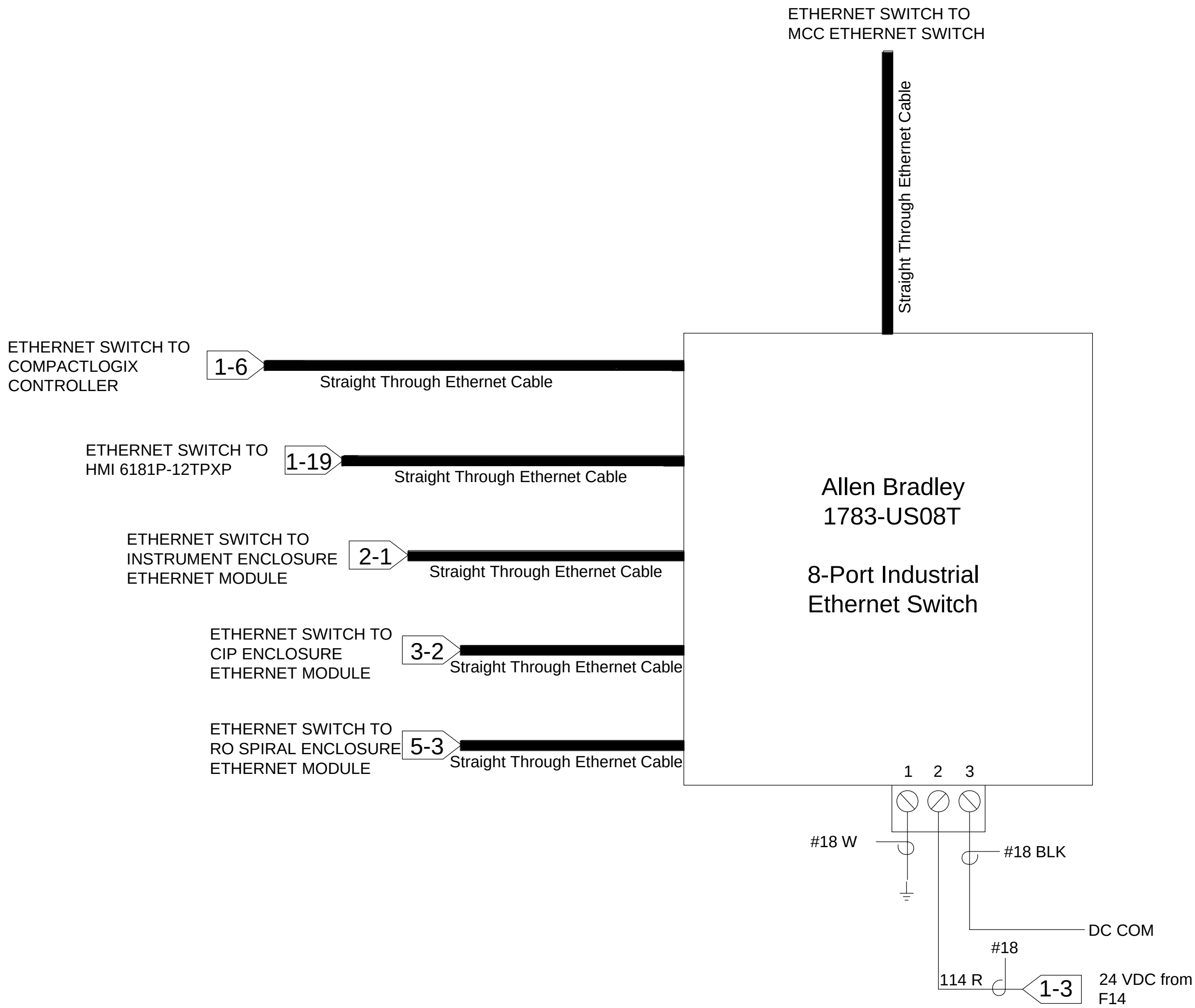
NOTE: Terminate end of communication bus with a right end cap (1769-ECR)

NEW LOGIC RESEARCH

Series i Electrical Schematic
PLC_6-7AO

SIGNATURES		DATE	SIZE	DWG NO.	FILE	REV
ELECTRICAL ENGINEER	KWK	7/9/13	A	1-16	iEL 4-440-60-ac SDL	
ELECTRICAL MANAGER	EB	11/22/13	PROJECT: Santo Domingo Landfill-MAIN		SHEET	16 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

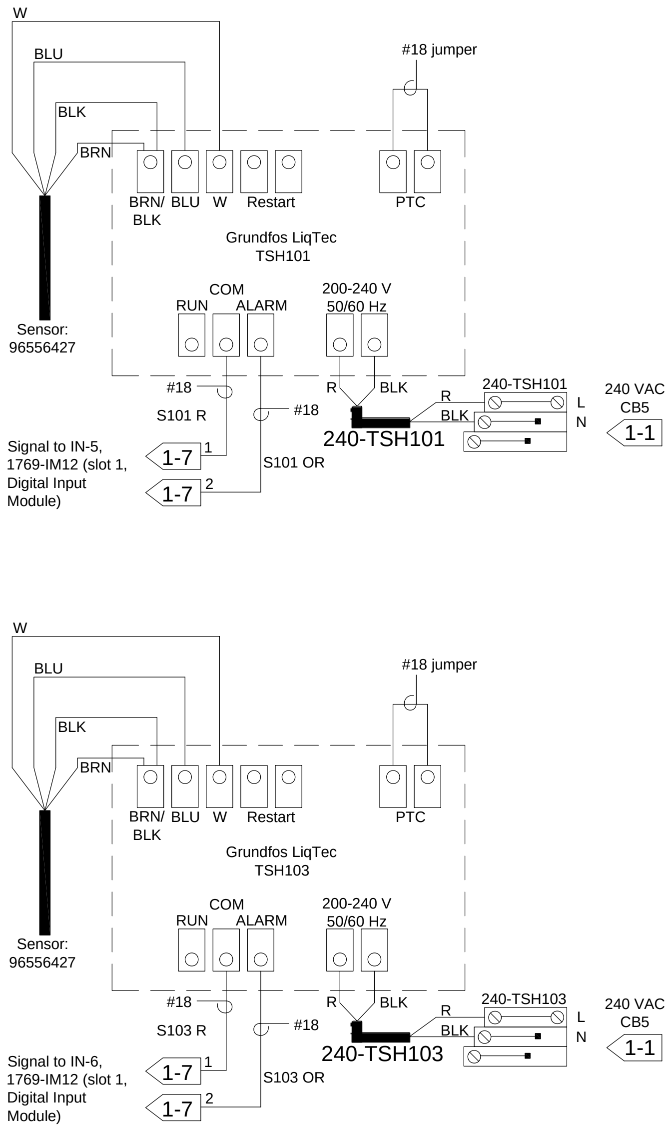
Series i Electrical Schematic
Ethernet Switch

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-17	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN — SHEET 17 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

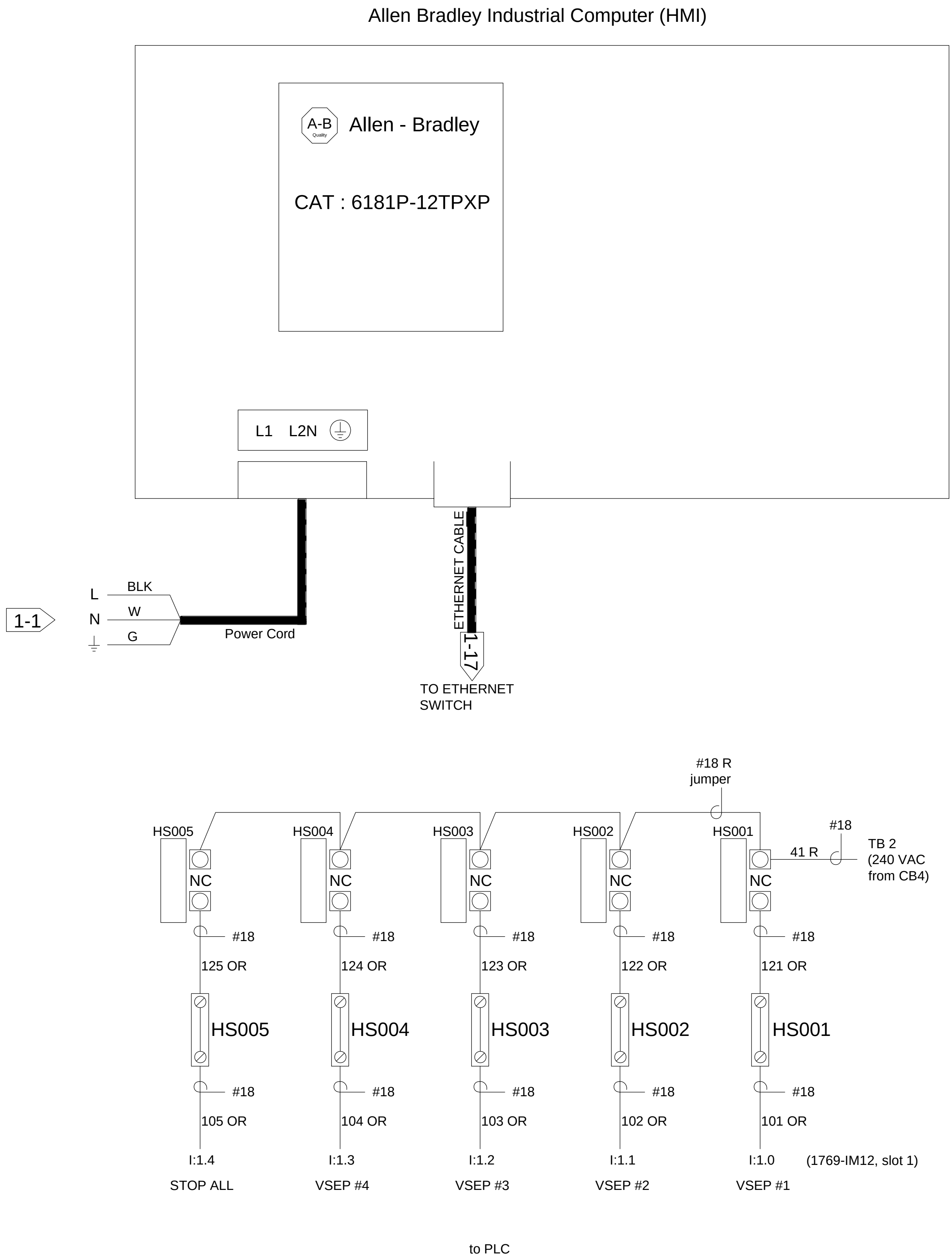
Series i Electrical Schematic
Pump Seal Switch

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-18	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



COMPONENTS ON DOOR

NEW LOGIC RESEARCH

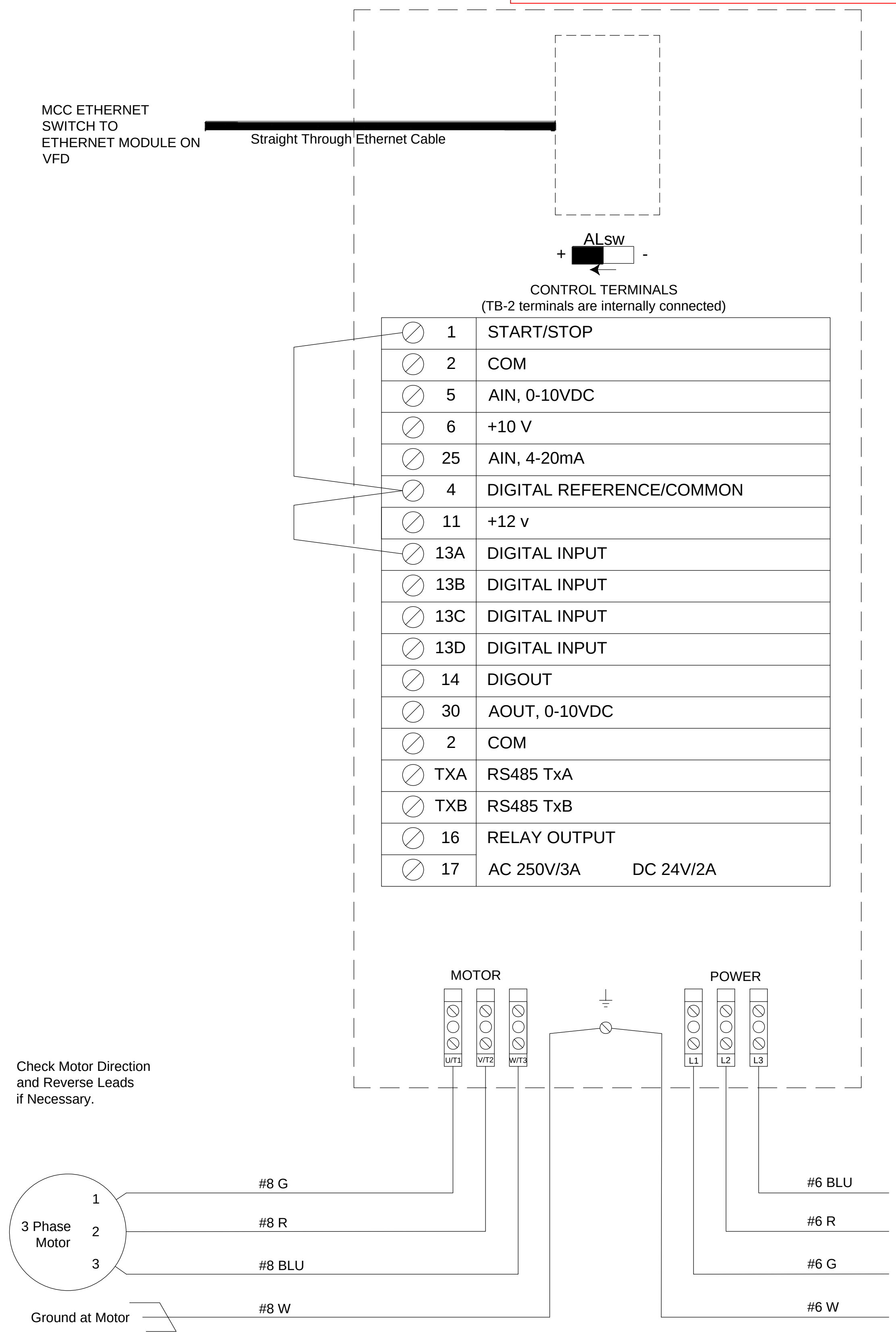
Series i Electrical Schematic
Main Enclosure Door

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-19	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN | SHEET 19 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P100 VFD
AC Tech ESV183 25HP, 440 VAC

NEW LOGIC RESEARCH

Series i Electrical Schematic
M-P100 VFD

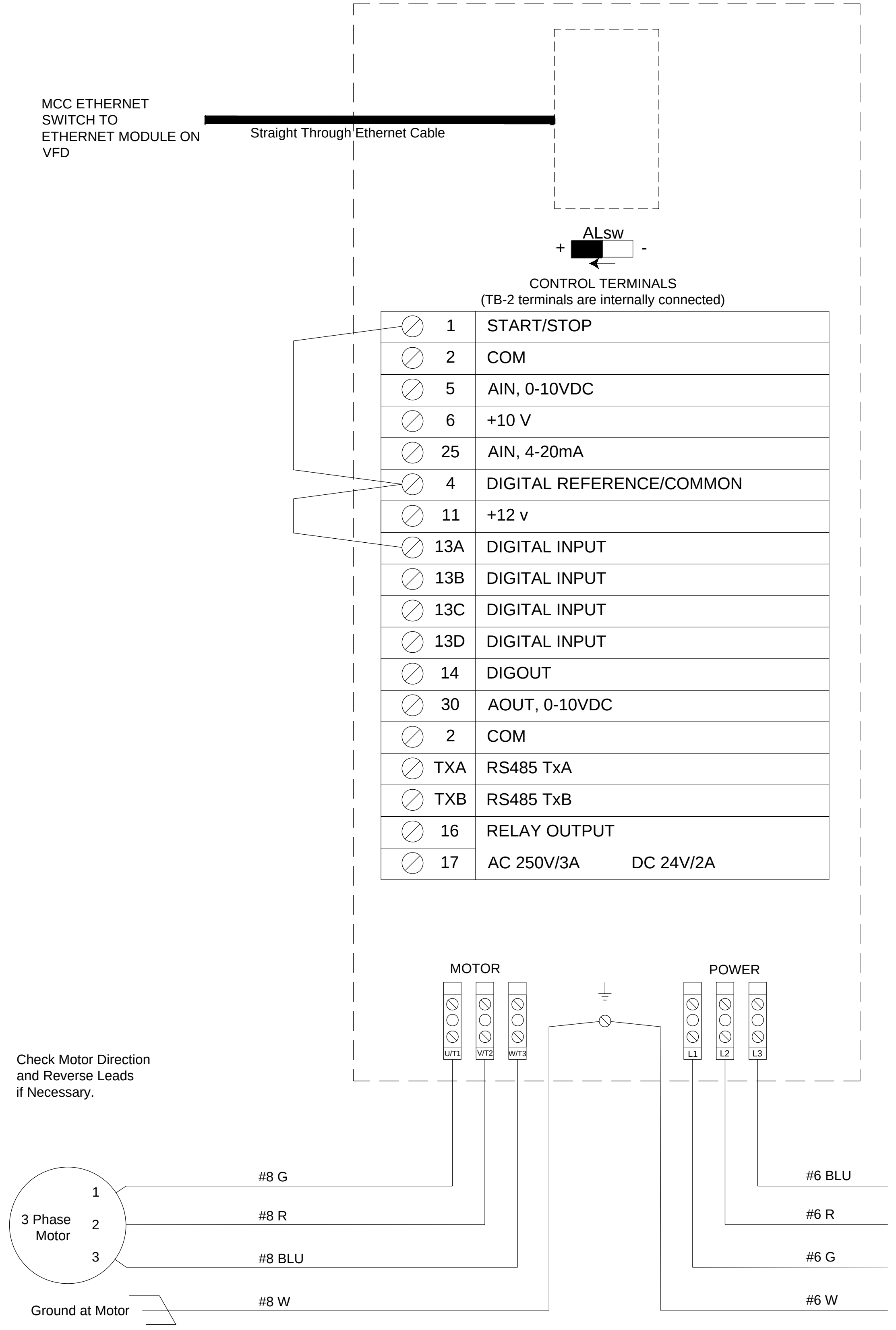
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-20	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN

SHEET 20 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P101 VFD
AC Tech ESV183 25HP, 440 VAC

NEW LOGIC RESEARCH

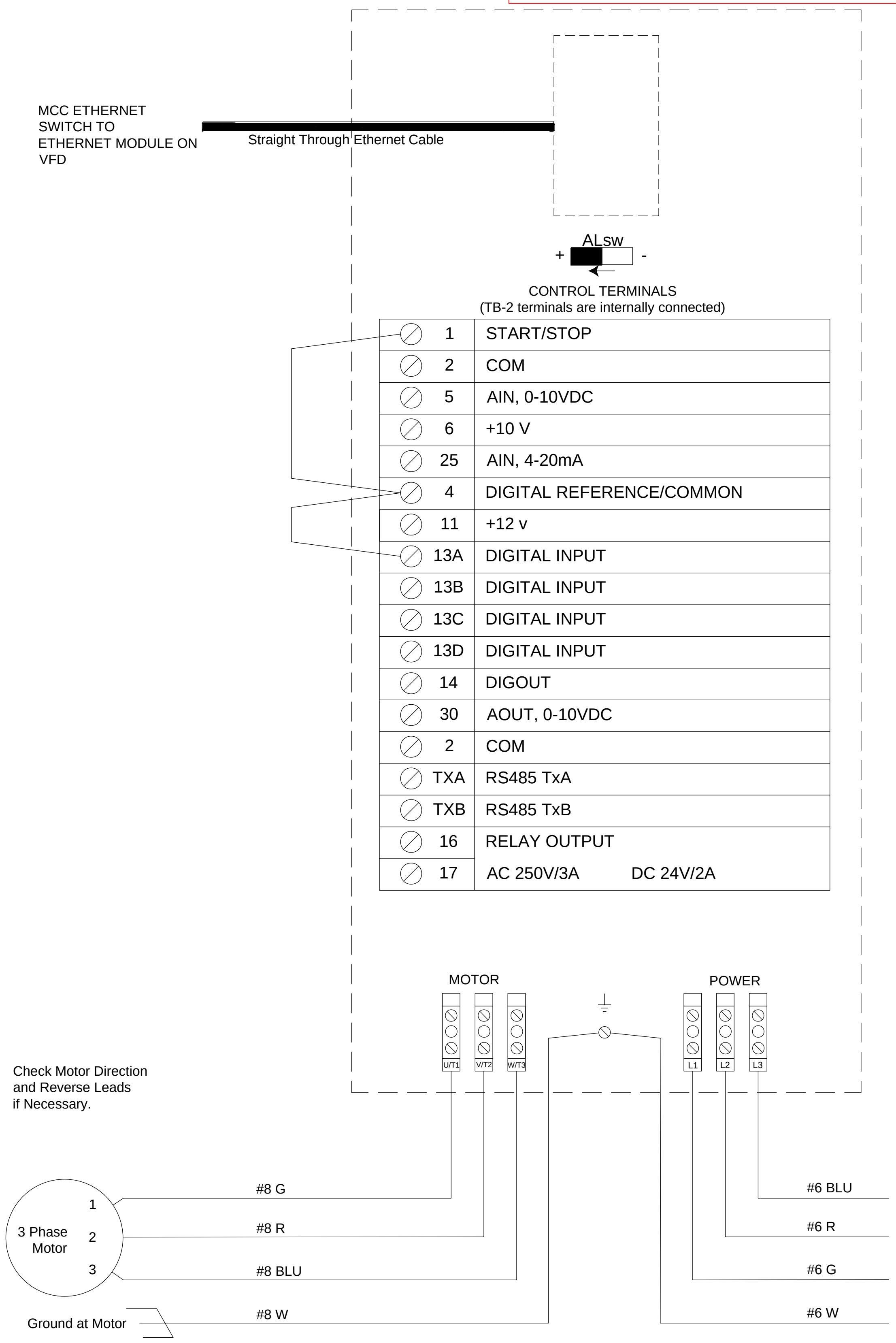
Series i Electrical Schematic
M-P101 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-21	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 21 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P102 VFD
AC Tech ESV183 25HP, 440 VAC

NEW LOGIC RESEARCH

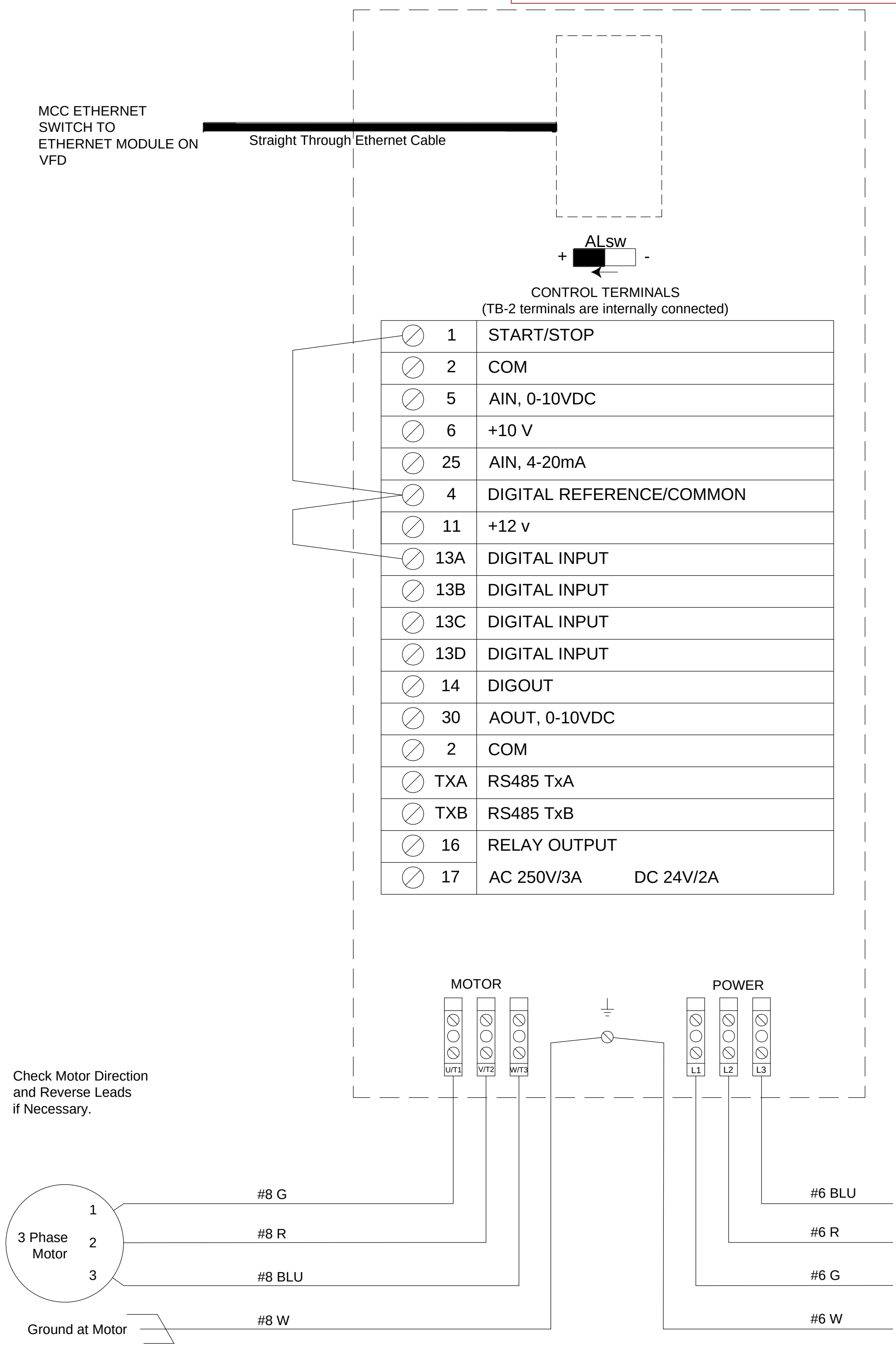
Series i Electrical Schematic
M-P102 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-22	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 22 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VSEP FEED PUMP MOTOR M-P103 VFD
AC Tech ESV183 25HP, 440 VAC

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

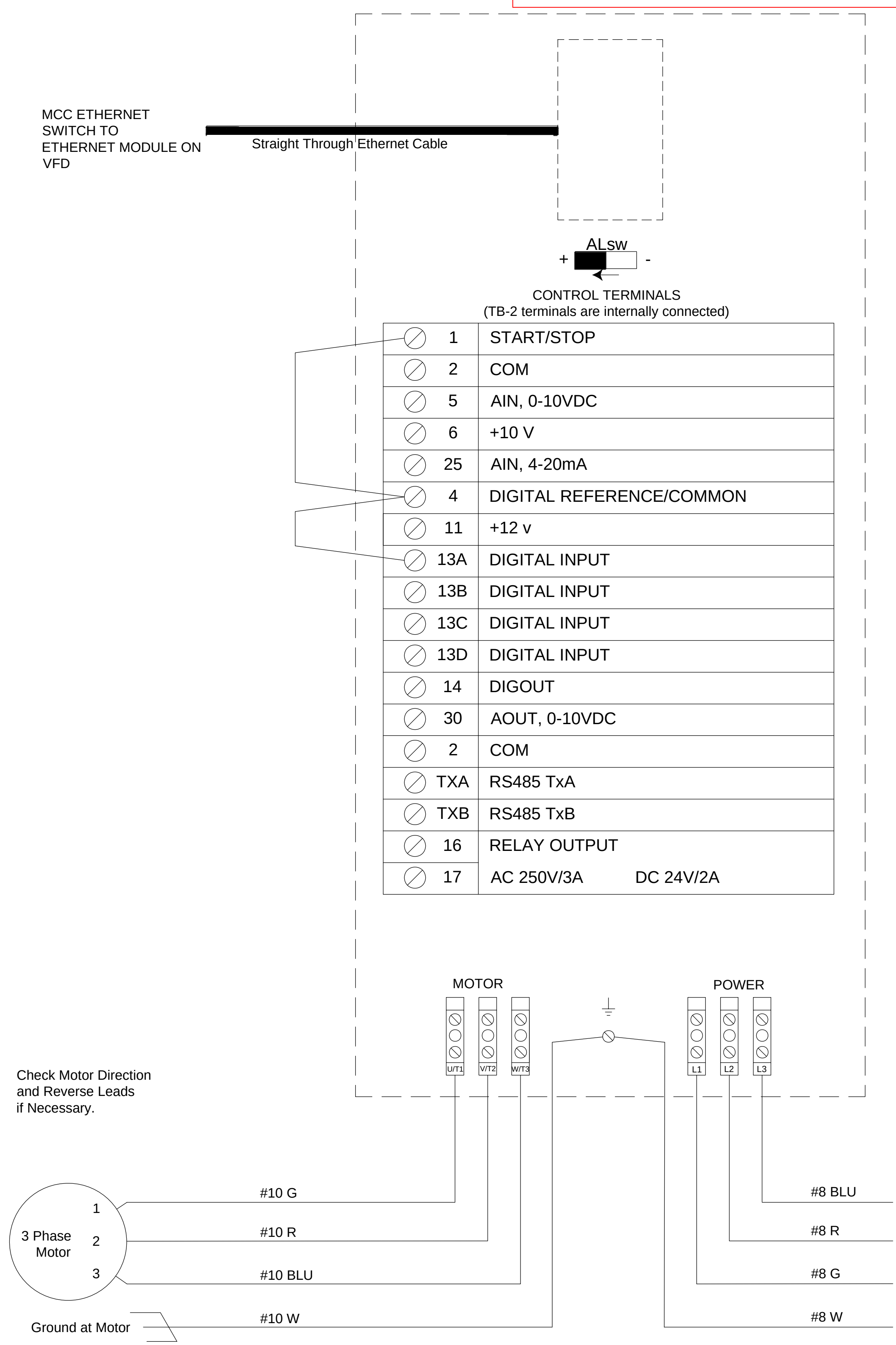
NEW LOGIC RESEARCH

Series i Electrical Schematic
M-P103 VFD

SIZE	DWG NO.	FILE	REV
A	1-23	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 23 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



CIP FEED PUMP MOTOR M-P190 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

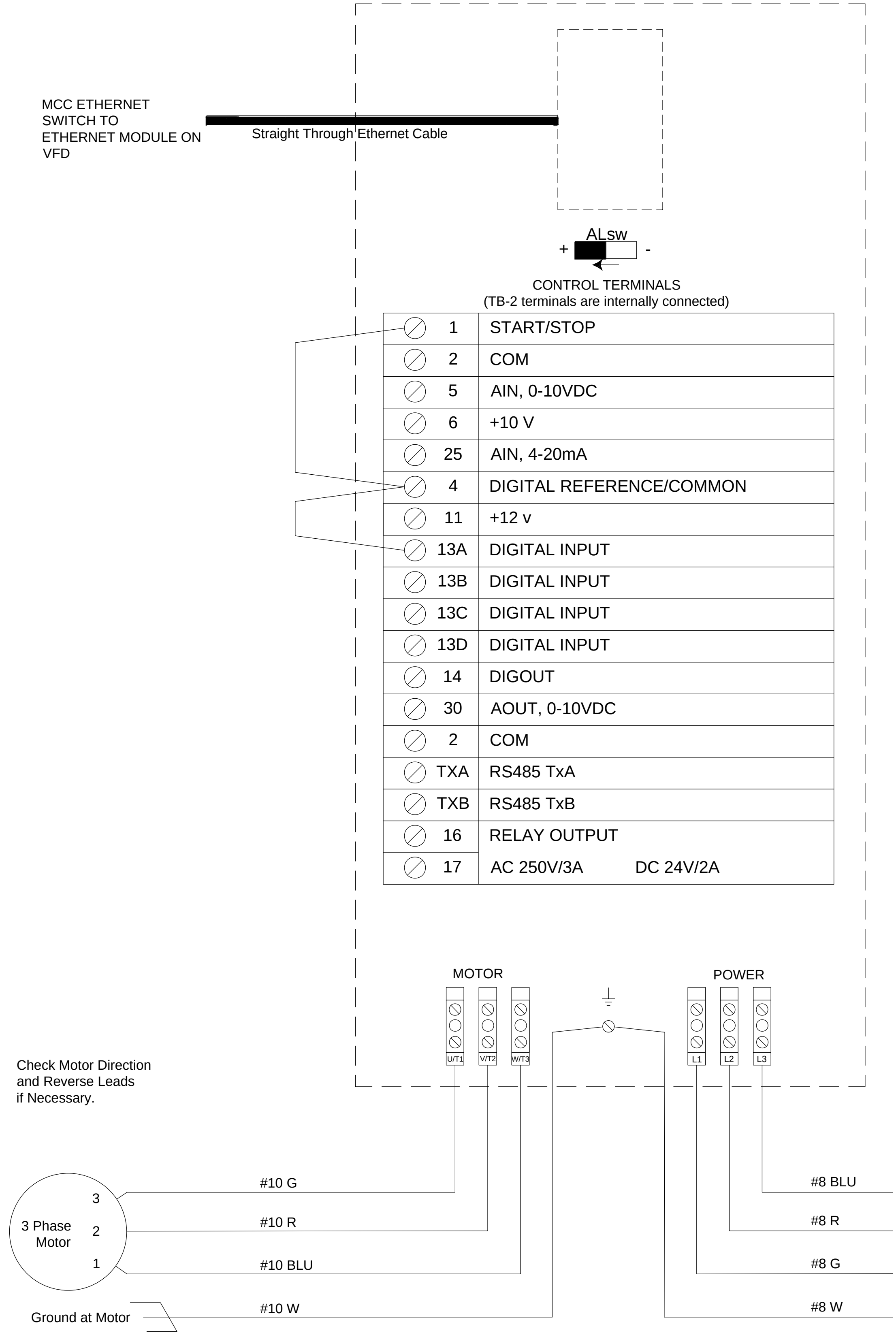
Series i Electrical Schematic
M-P190 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-24	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 24 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V110 VFD
AC Tech ESV153 20HP, 440 VAC

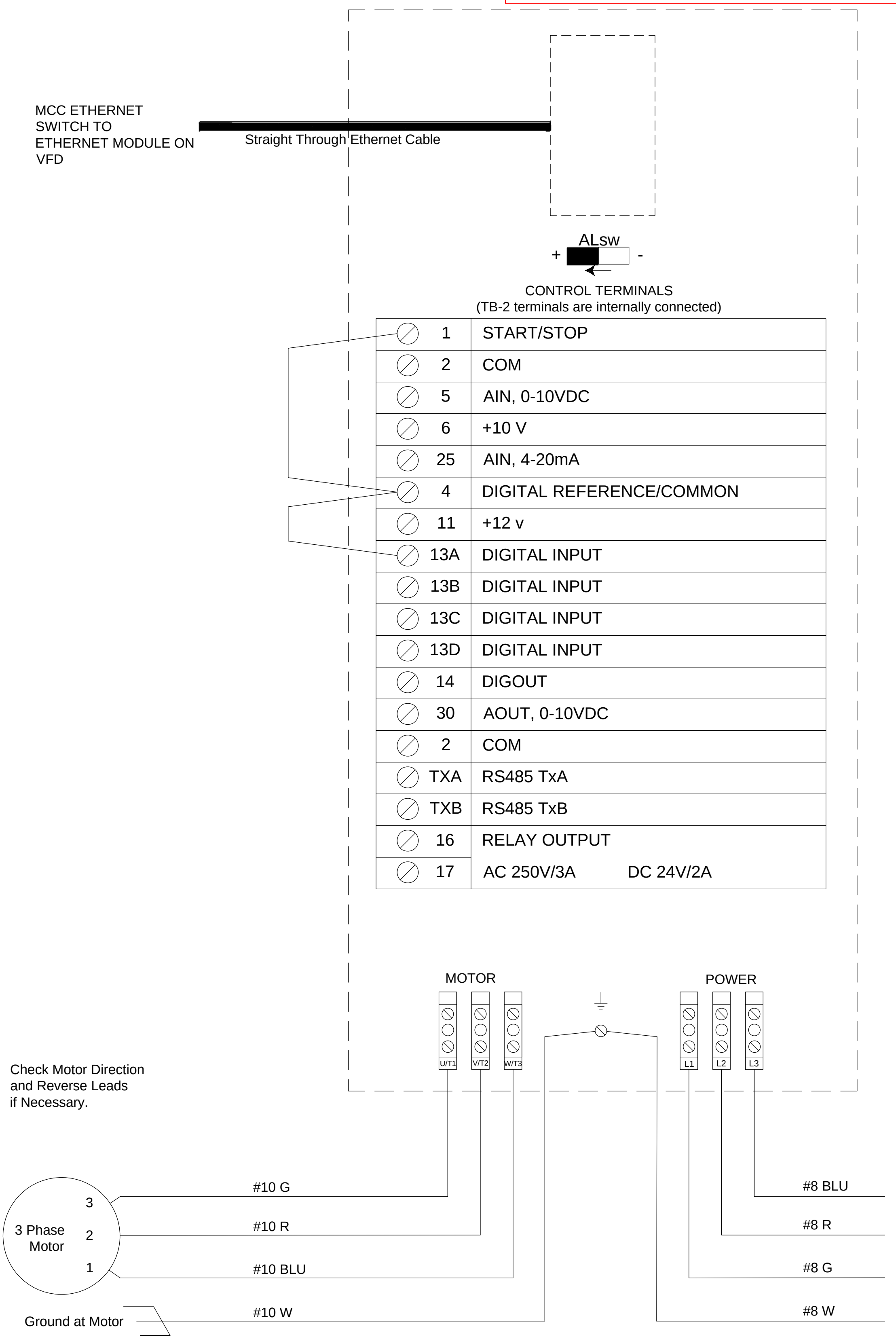
NEW LOGIC RESEARCH

Series i Electrical Schematic
M-V110 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-25	iEL 4-440-60-ac SDL	
PROJECT: Santo Domingo Landfill-MAIN		SHEET 25 of 49	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V120 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

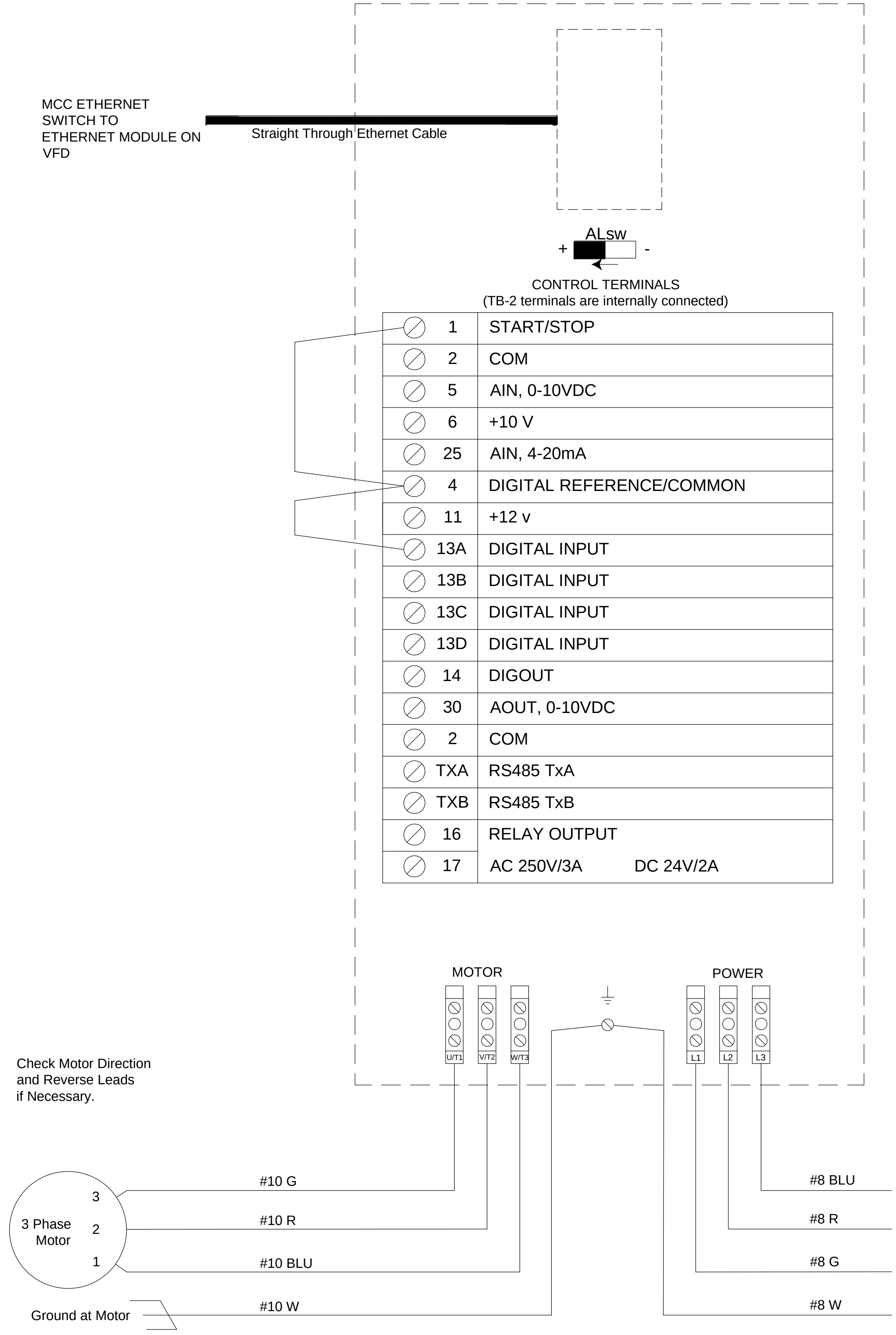
Series i Electrical Schematic
M-V120 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-26	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 26 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V130 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

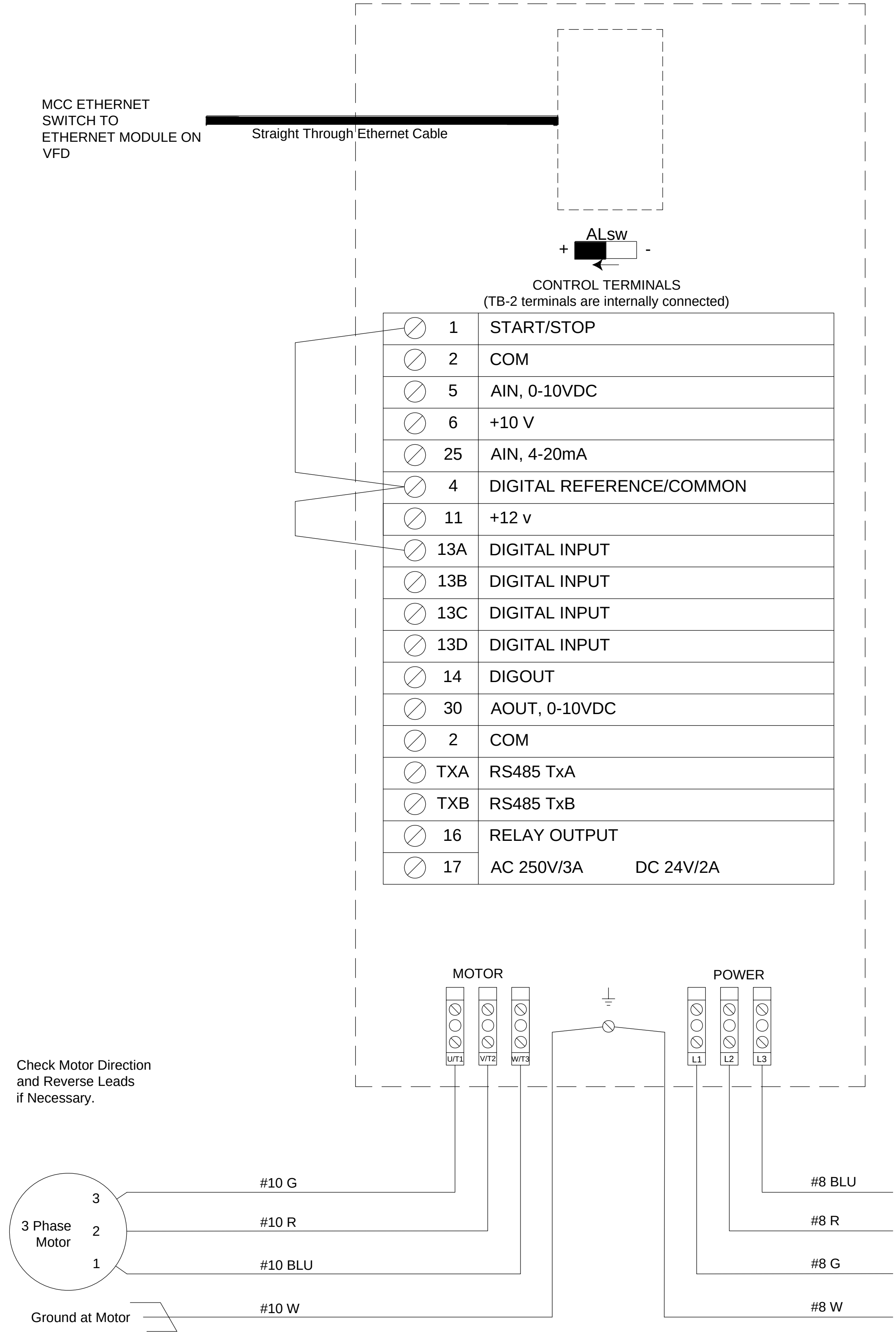
Series i Electrical Schematic
M-V130 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-27	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 27 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



VIBRATION MOTOR M-V140 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

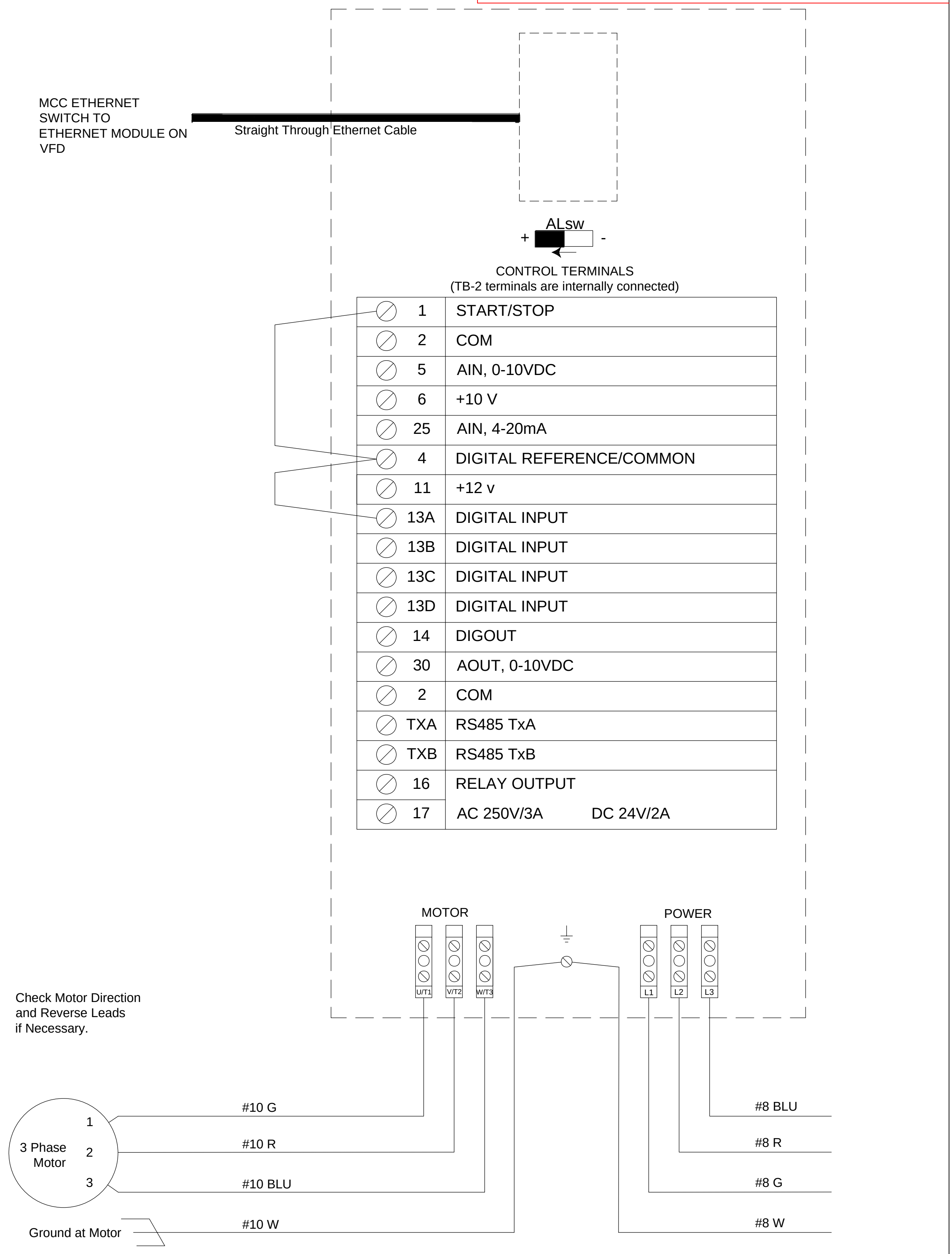
Series i Electrical Schematic
M-V140 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-28	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 28 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



RO SPIRAL FEED PUMP MOTOR M-P200 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

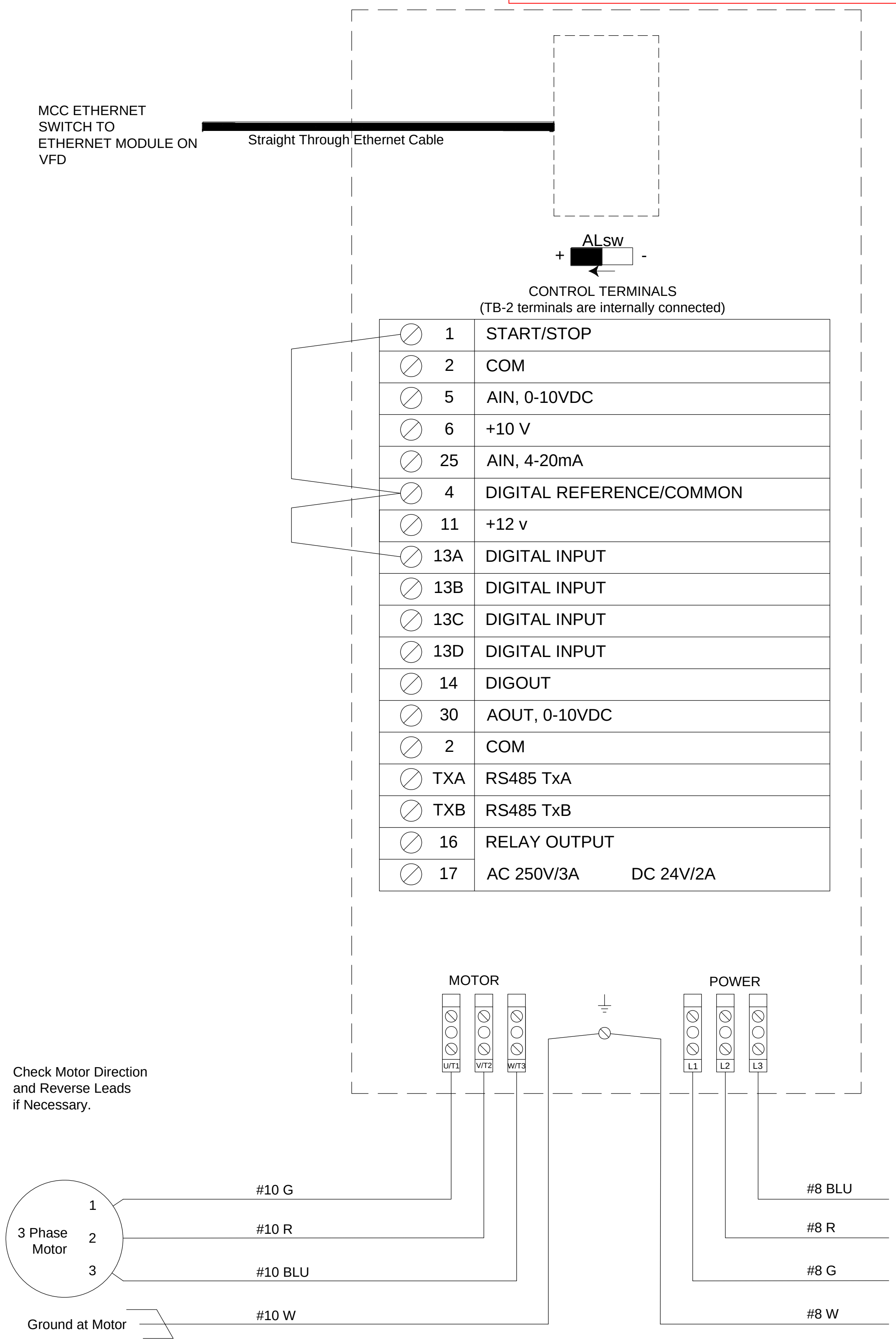
Series i Electrical Schematic
M-P200 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-29	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN SHEET 29 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



RO SPIRAL FEED PUMP MOTOR M-P201 VFD
AC Tech ESV153 20HP, 440 VAC

NEW LOGIC RESEARCH

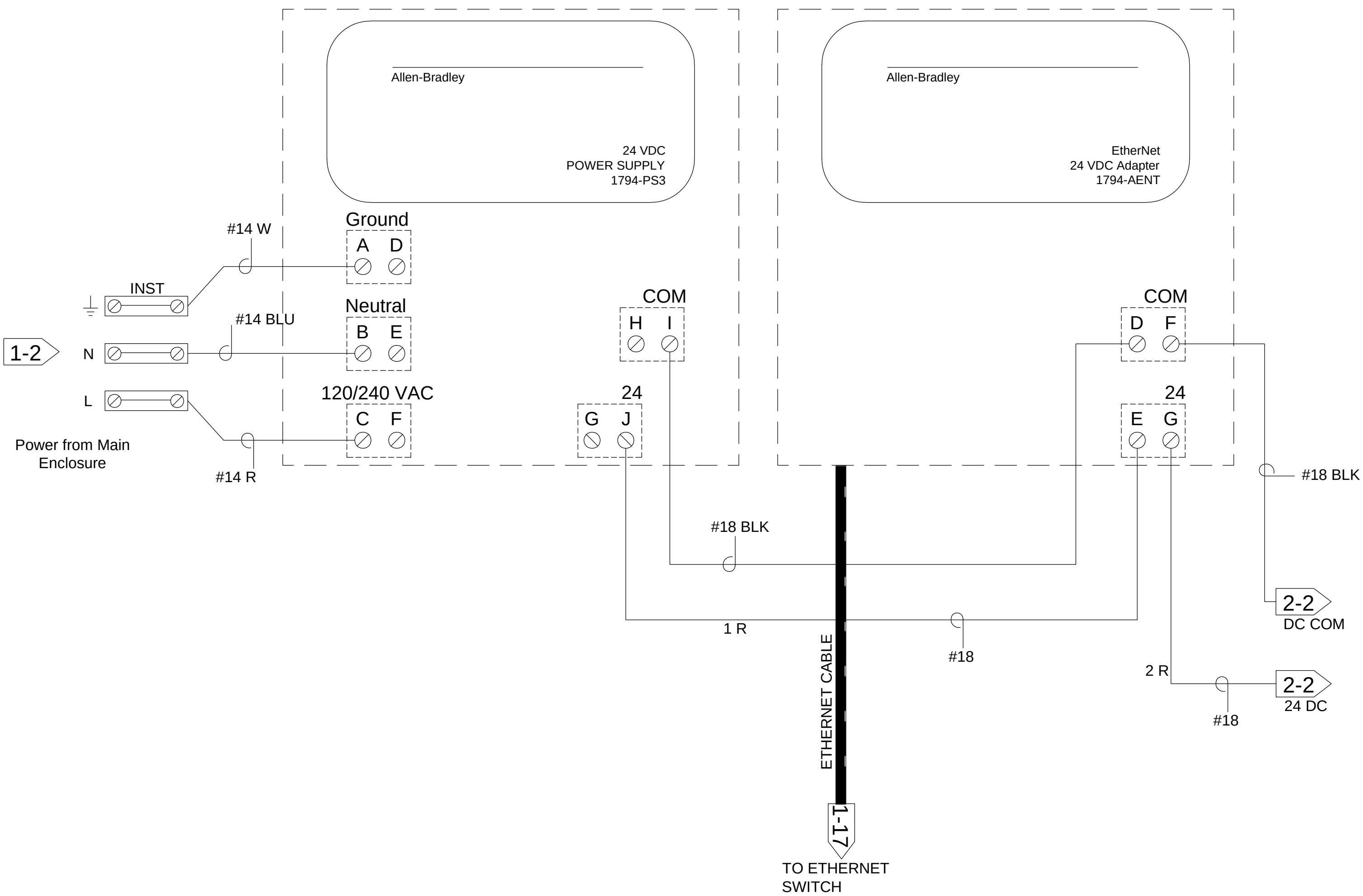
Series i Electrical Schematic
M-P201 VFD

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	1-30	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-MAIN | SHEET 30 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO

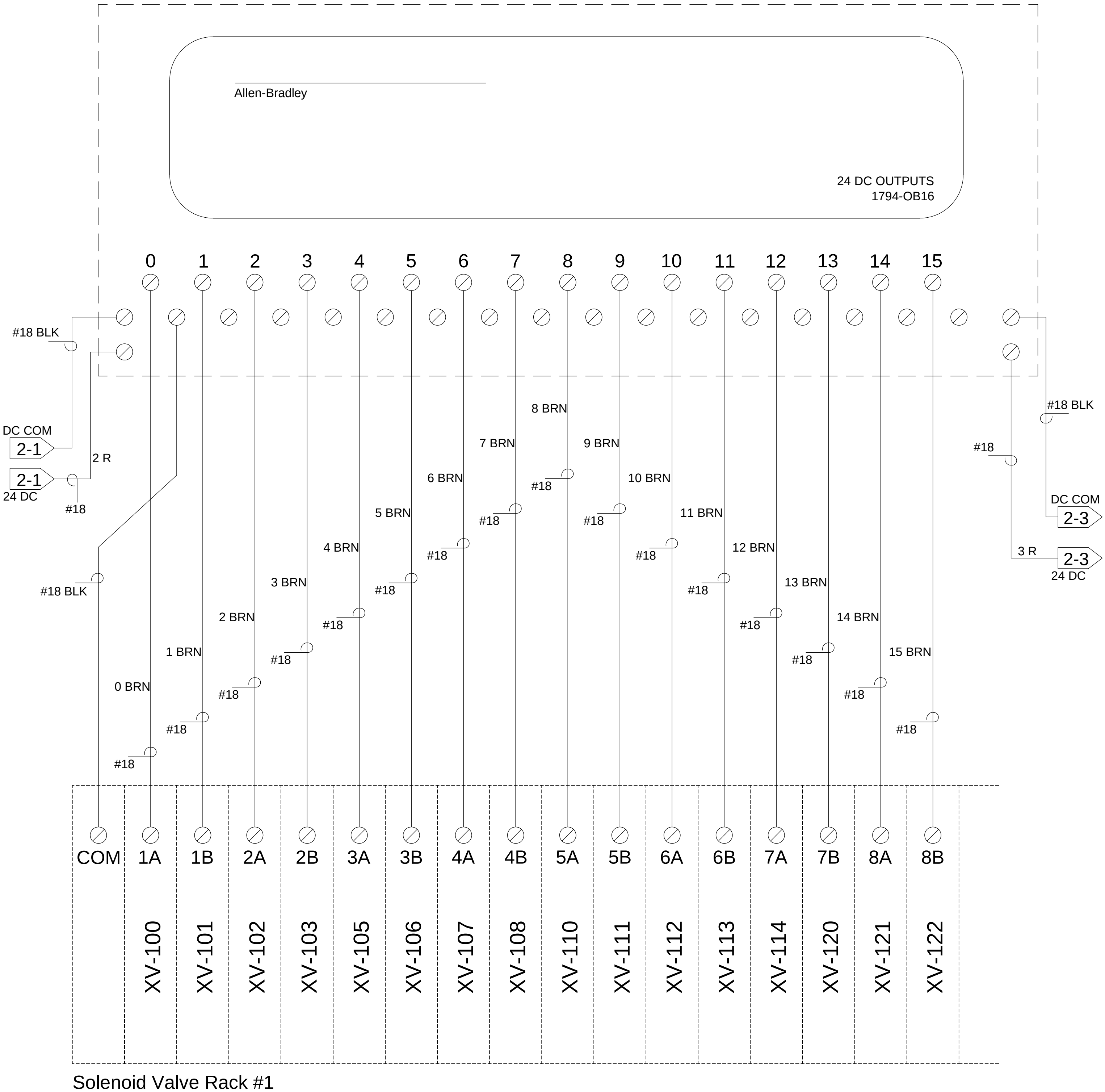
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST — SHEET 31 of 49

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

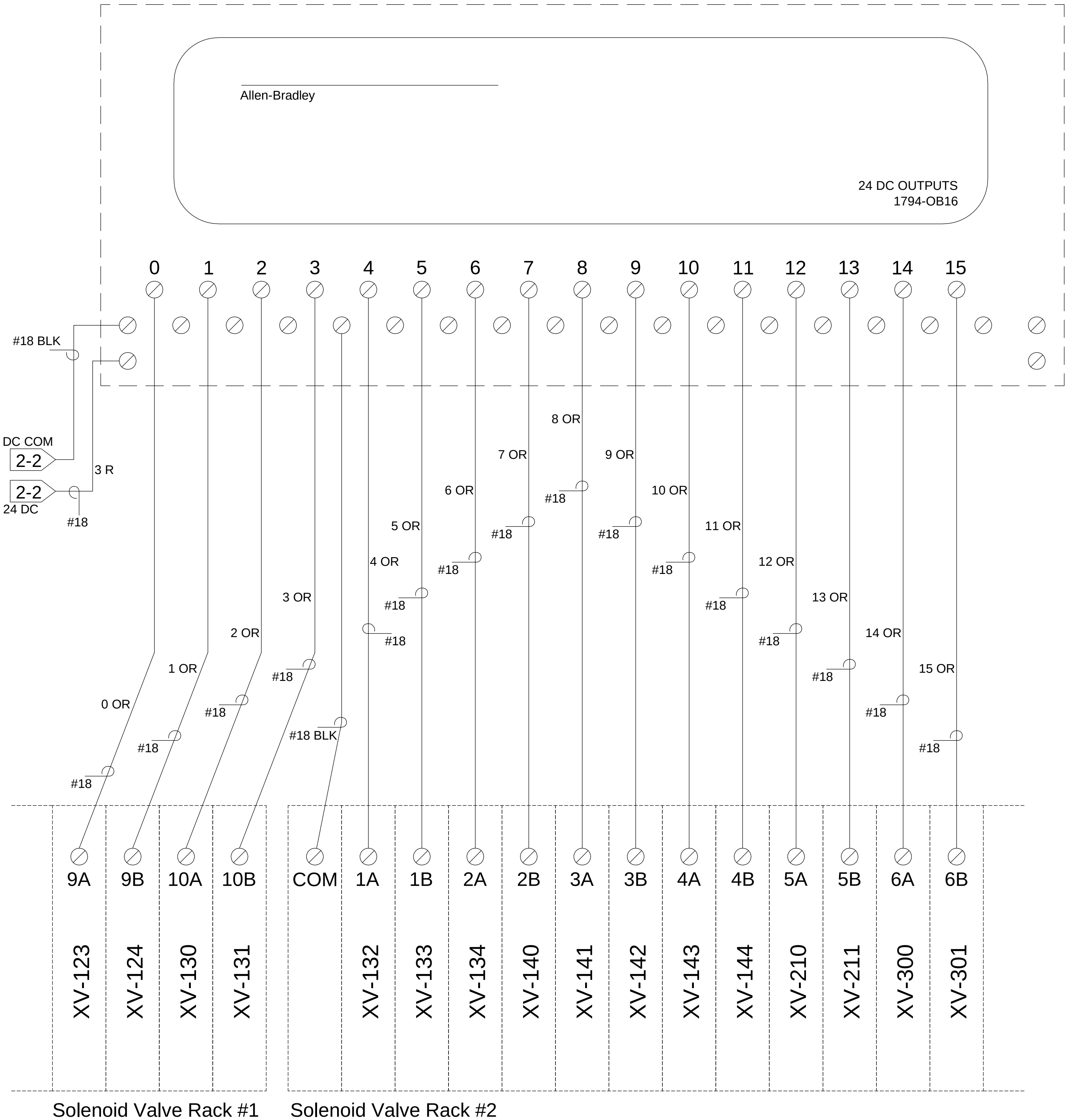
Series i Electrical Schematic
Flex IO - 1DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-2	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



20 x 24 VDC Solenoid Valves

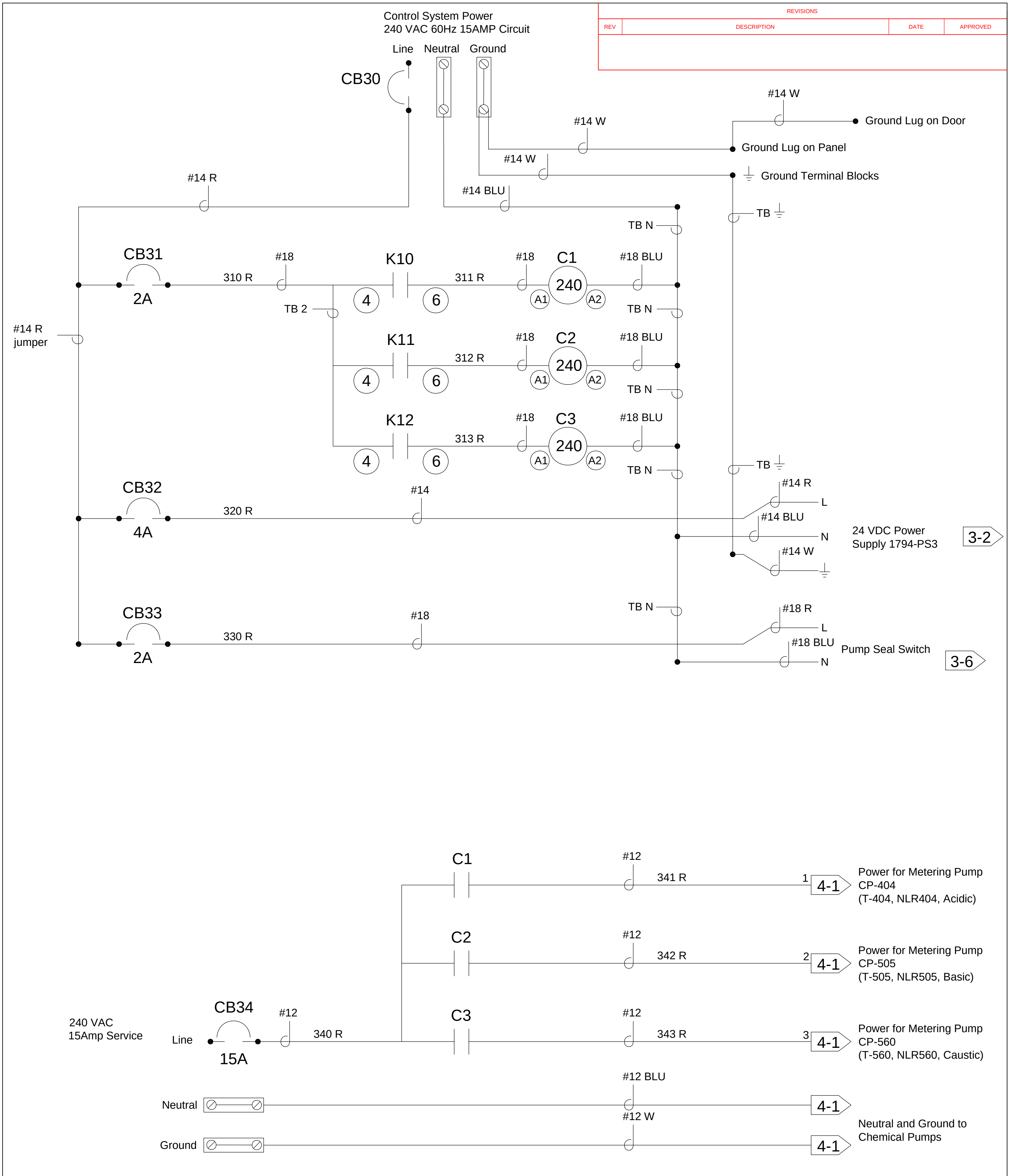
NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 2DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	2-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-INST SHEET 33 of 49



NEW LOGIC RESEARCH

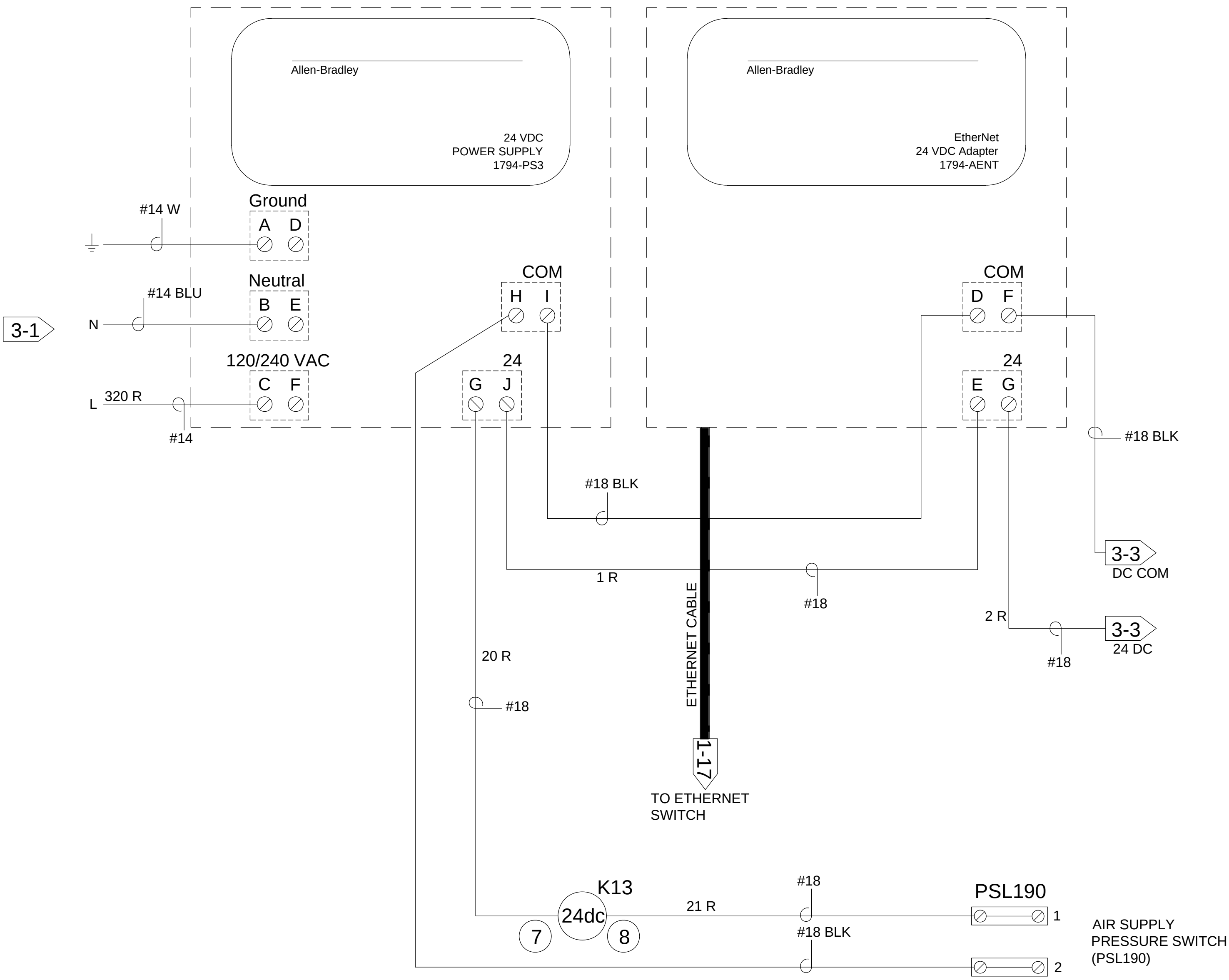
Series i Electrical Schematic
Single Phase

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE: A | DWG NO.: 3-1 | FILE: iEL 4-440-60-ac SDL | REV

PROJECT: Santo Domingo Landfill-CIP | SHEET: 34 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



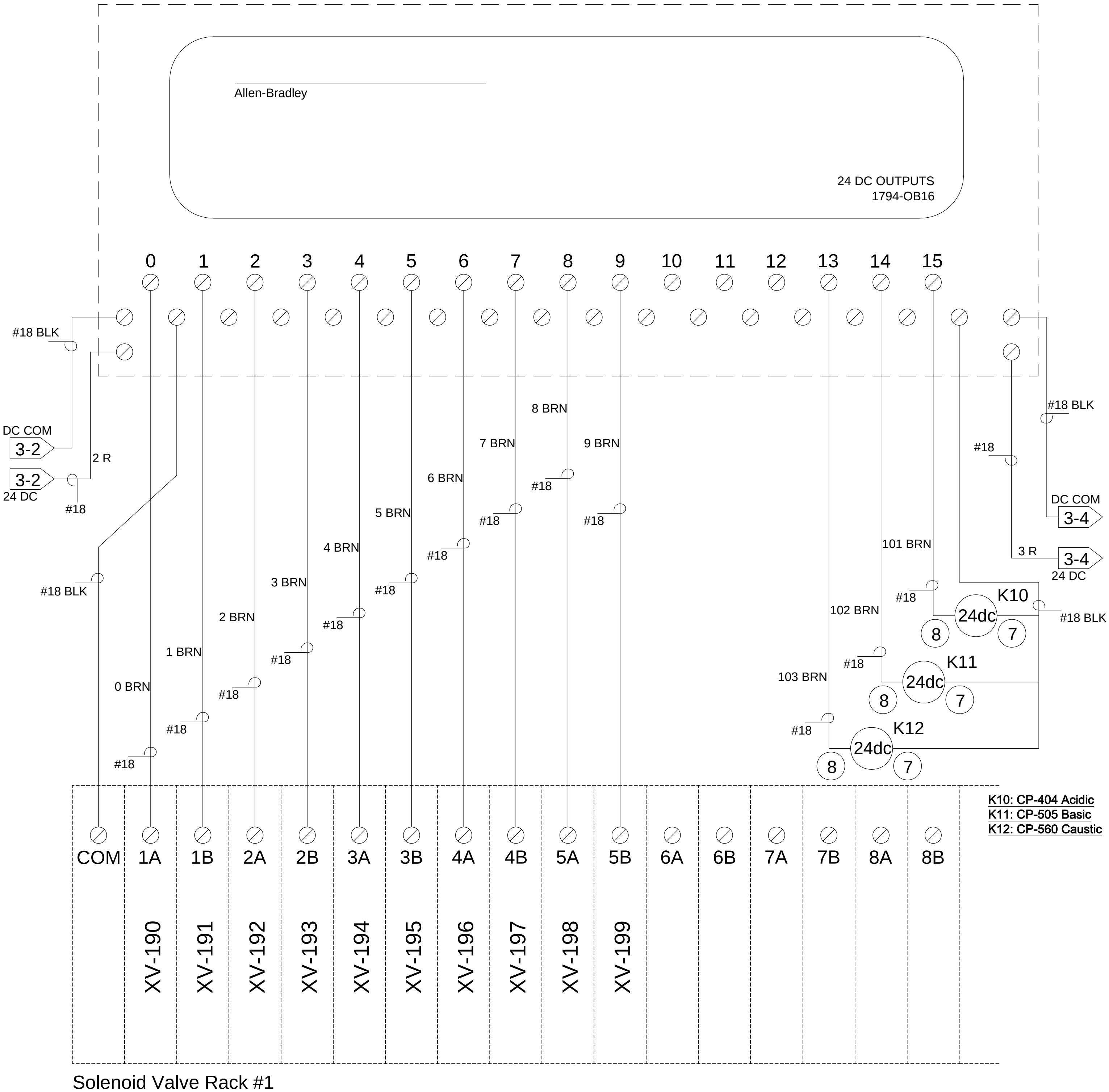
NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-2	iEL 4-440-60-ac SDL	
PROJECT:	Santo Domingo Landfill-CIP	SHEET	35 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

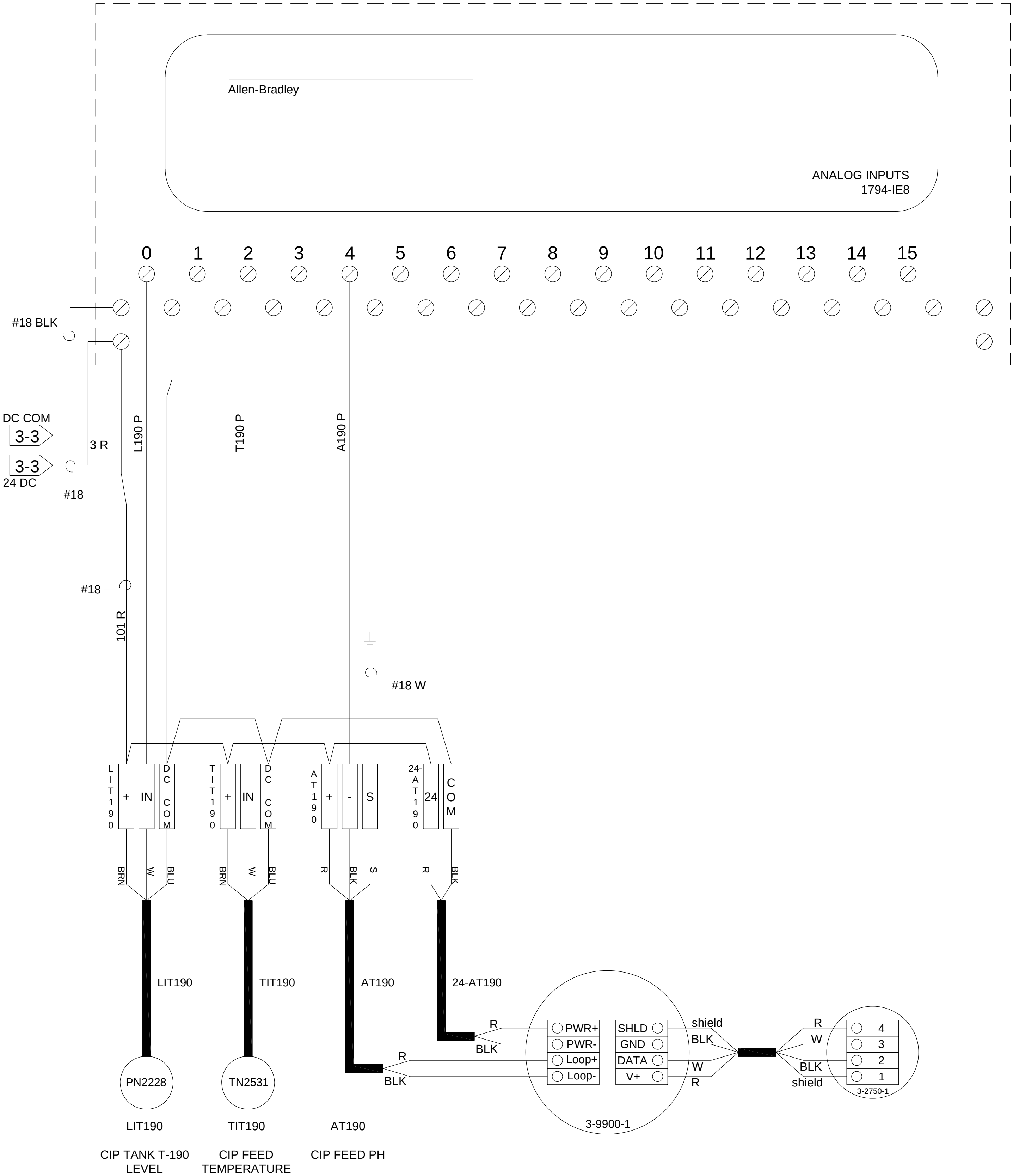
Series i Electrical Schematic
Flex IO - 1DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP SHEET 36 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

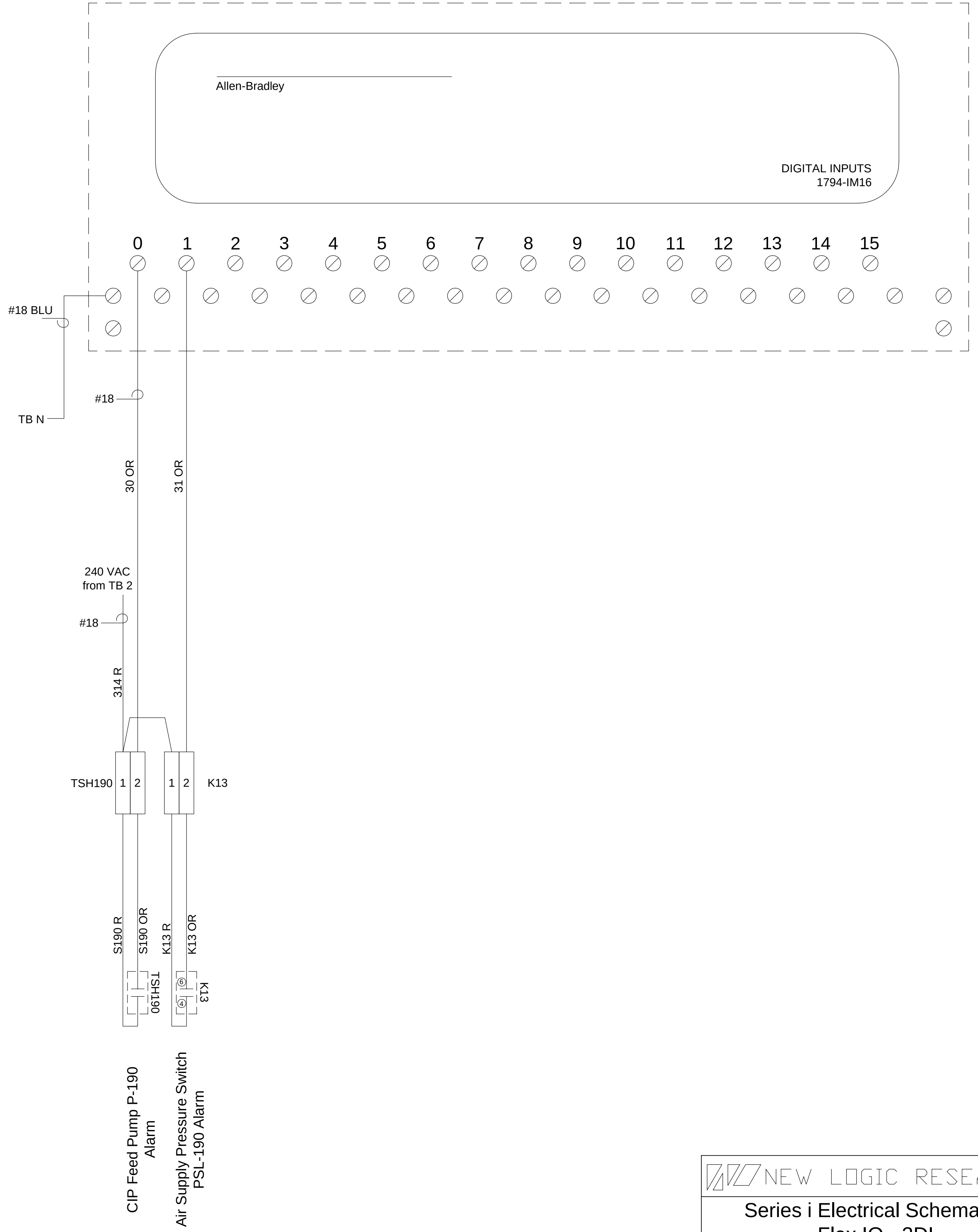
Series i Electrical Schematic
Flex IO - 2AI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP — SHEET 37 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 3DI

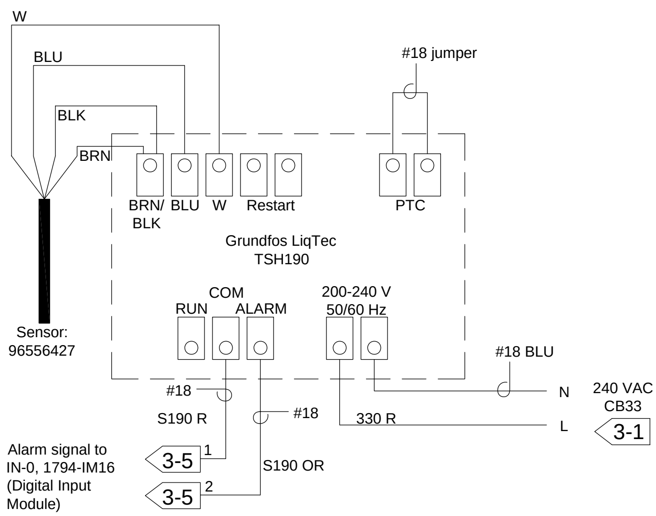
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	3-5	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP

SHEET 38 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

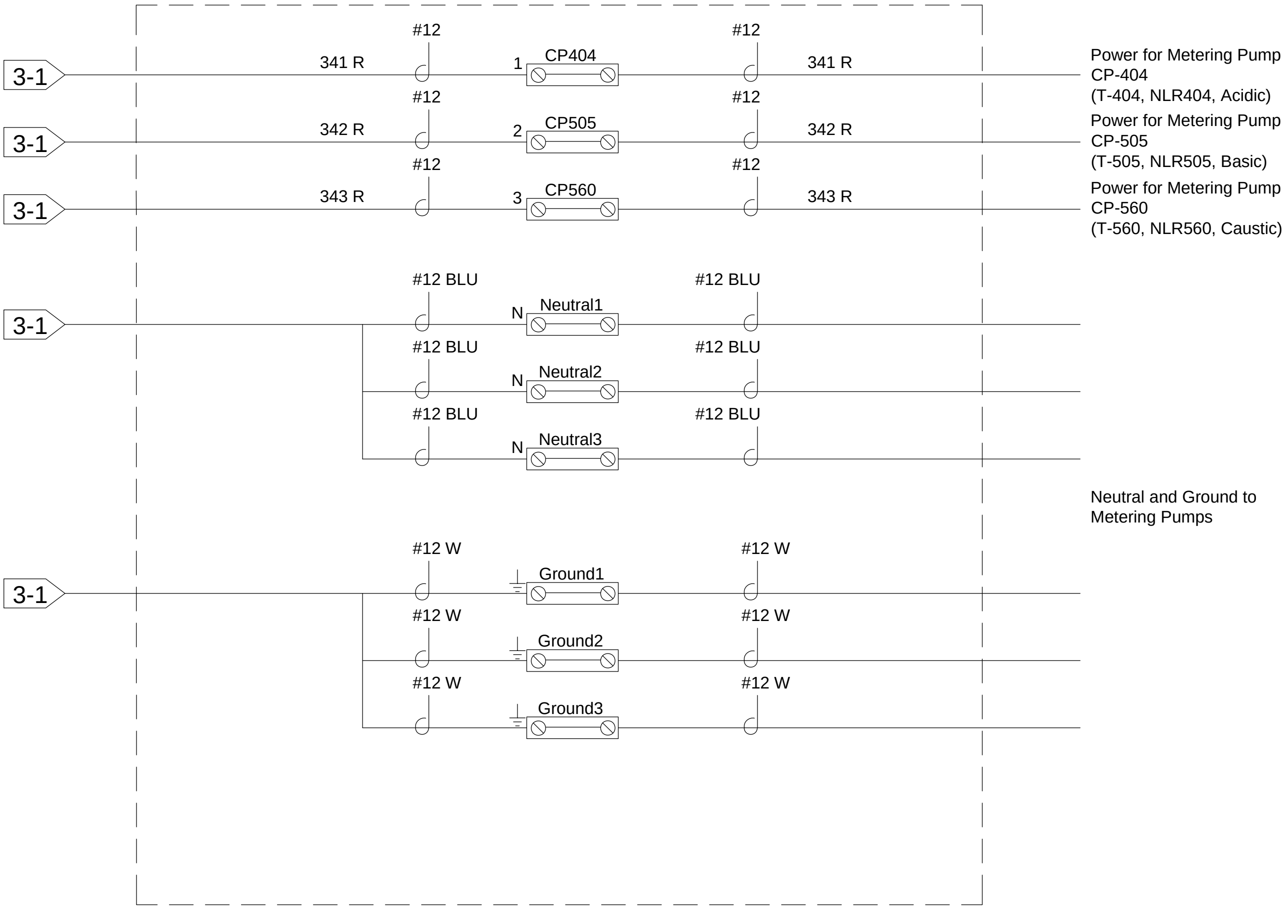
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

Series i Electrical Schematic
Pump Seal Switch

SIZE	DWG NO.	FILE	REV
A	3-6	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CIP | SHEET 39 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

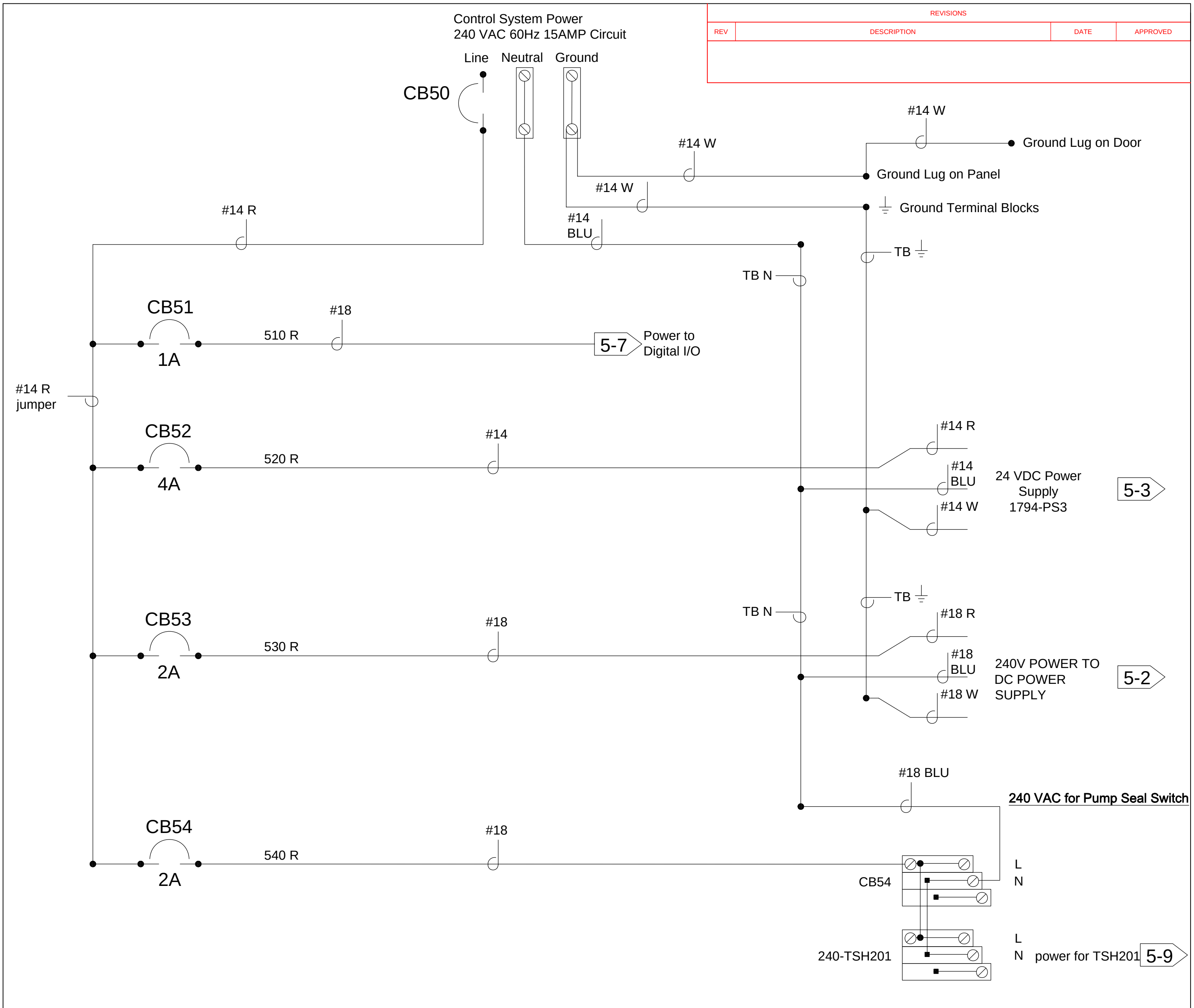
Series i Electrical Schematic
Metering Pump Enclosure

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	7/9/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	4-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-CHEM

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



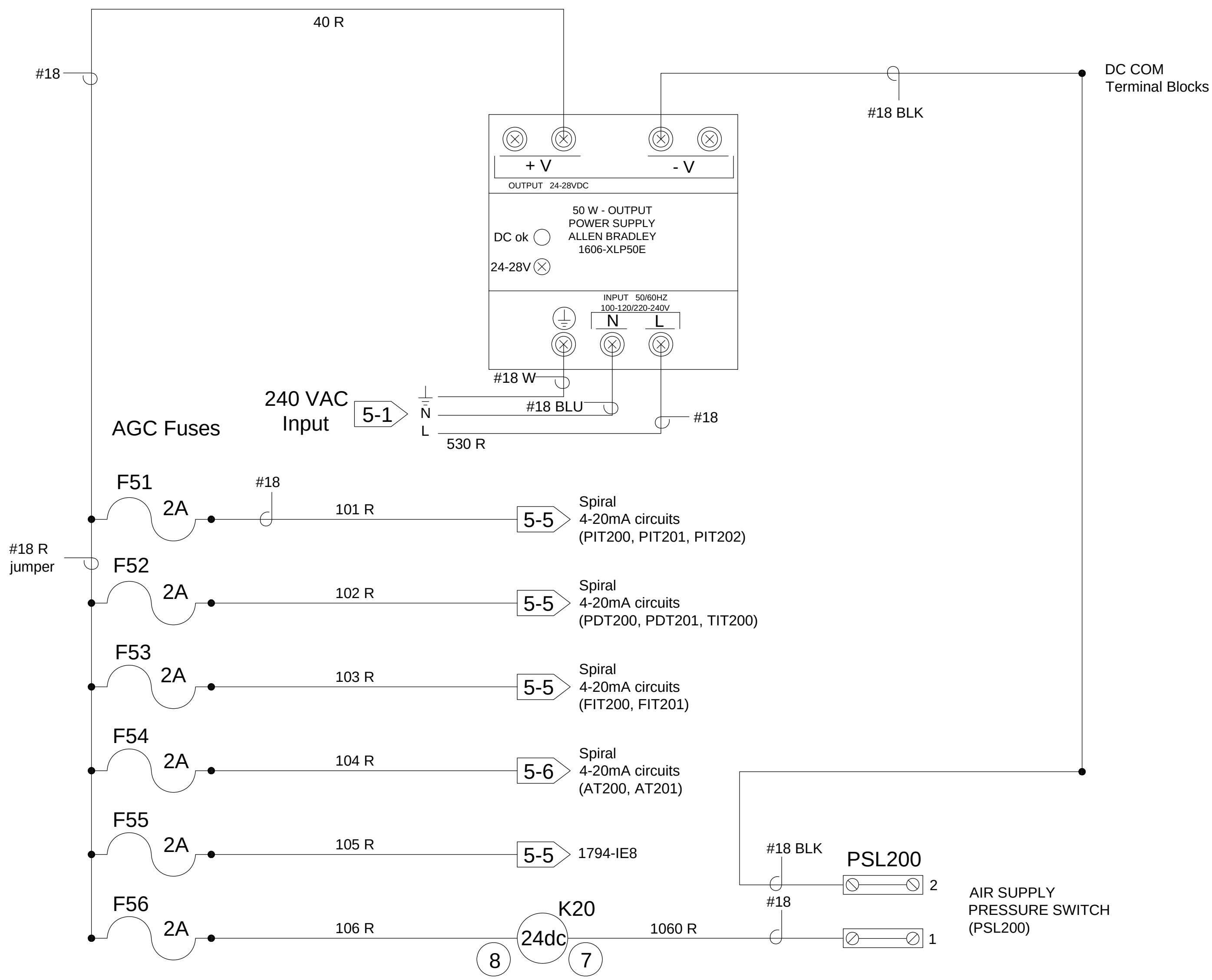
NEW LOGIC RESEARCH

Series i Electrical Schematic
Single Phase

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-1	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO SHEET 41 of 49



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

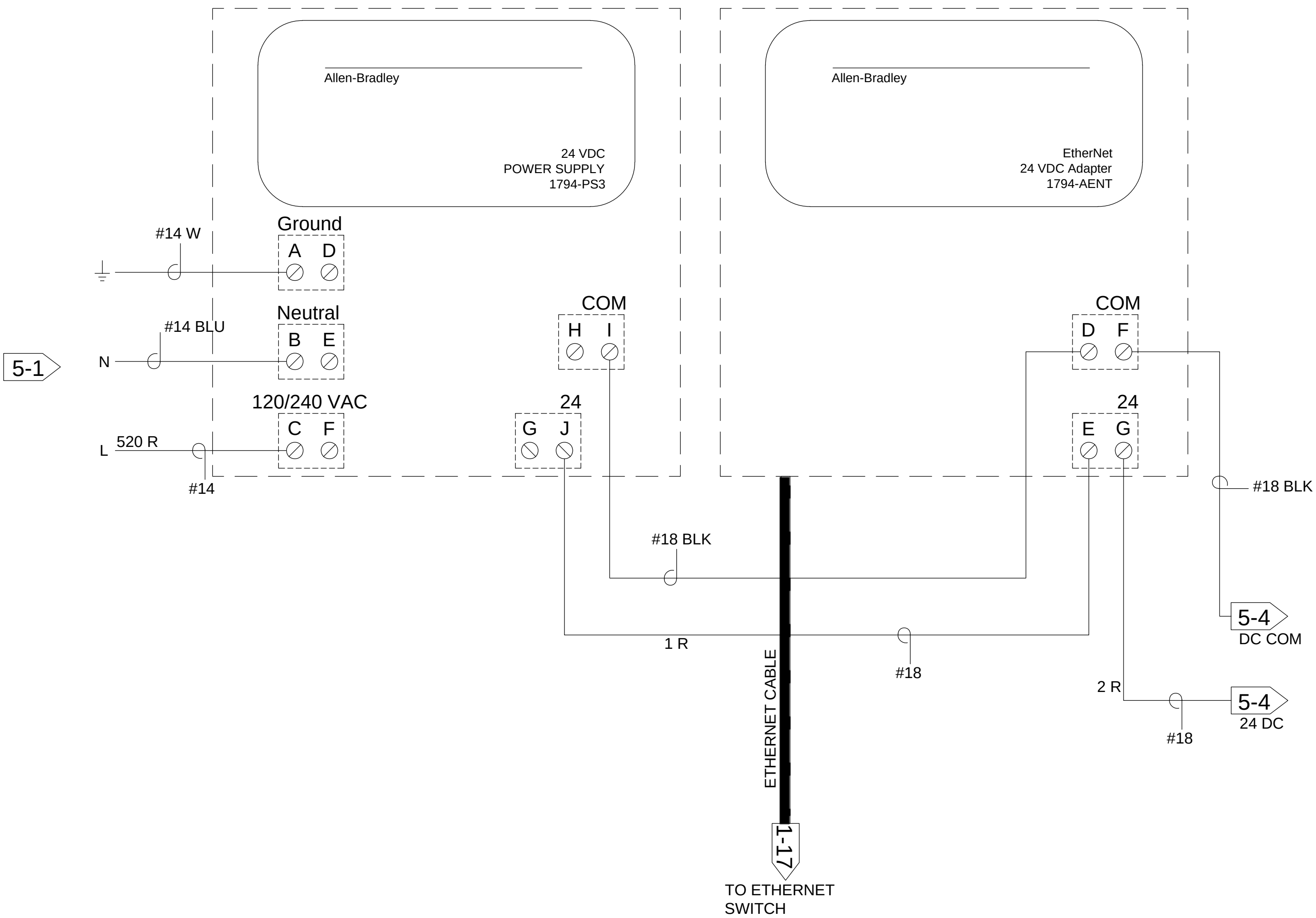
Series i Electrical Schematic
DC

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE: A | DWG NO.: 5-2 | FILE: iEL 4-440-60-ac SDL | REV:

PROJECT: Santo Domingo Landfill-RO | SHEET: 42 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

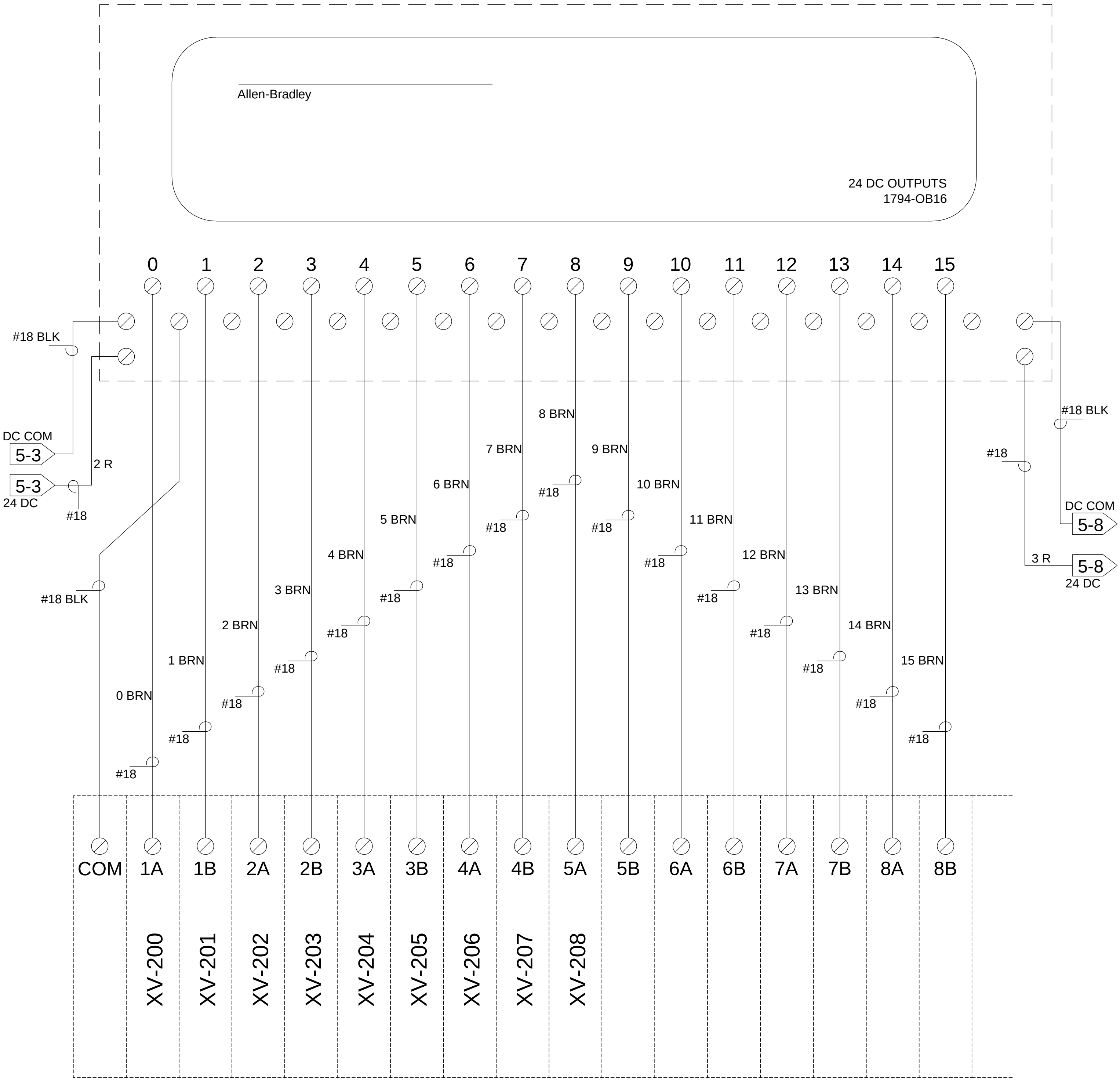
Series i Electrical Schematic
Flex IO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-3	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Solenoid Valve Rack #1

20 x 24 VDC Solenoid Valves

NEW LOGIC RESEARCH

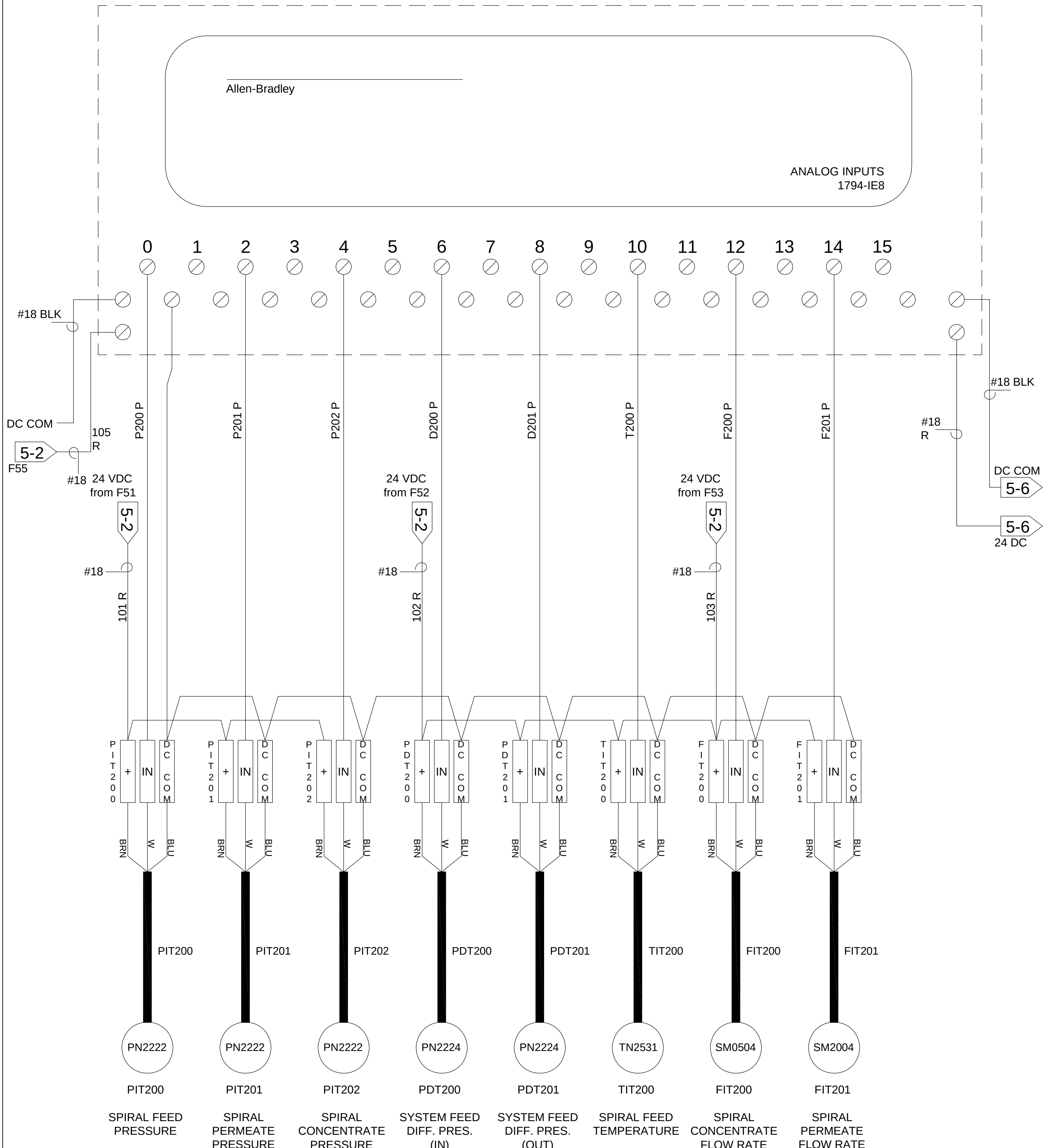
Series i Electrical Schematic
Flex IO - 1DO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-4	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO SHEET 44 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



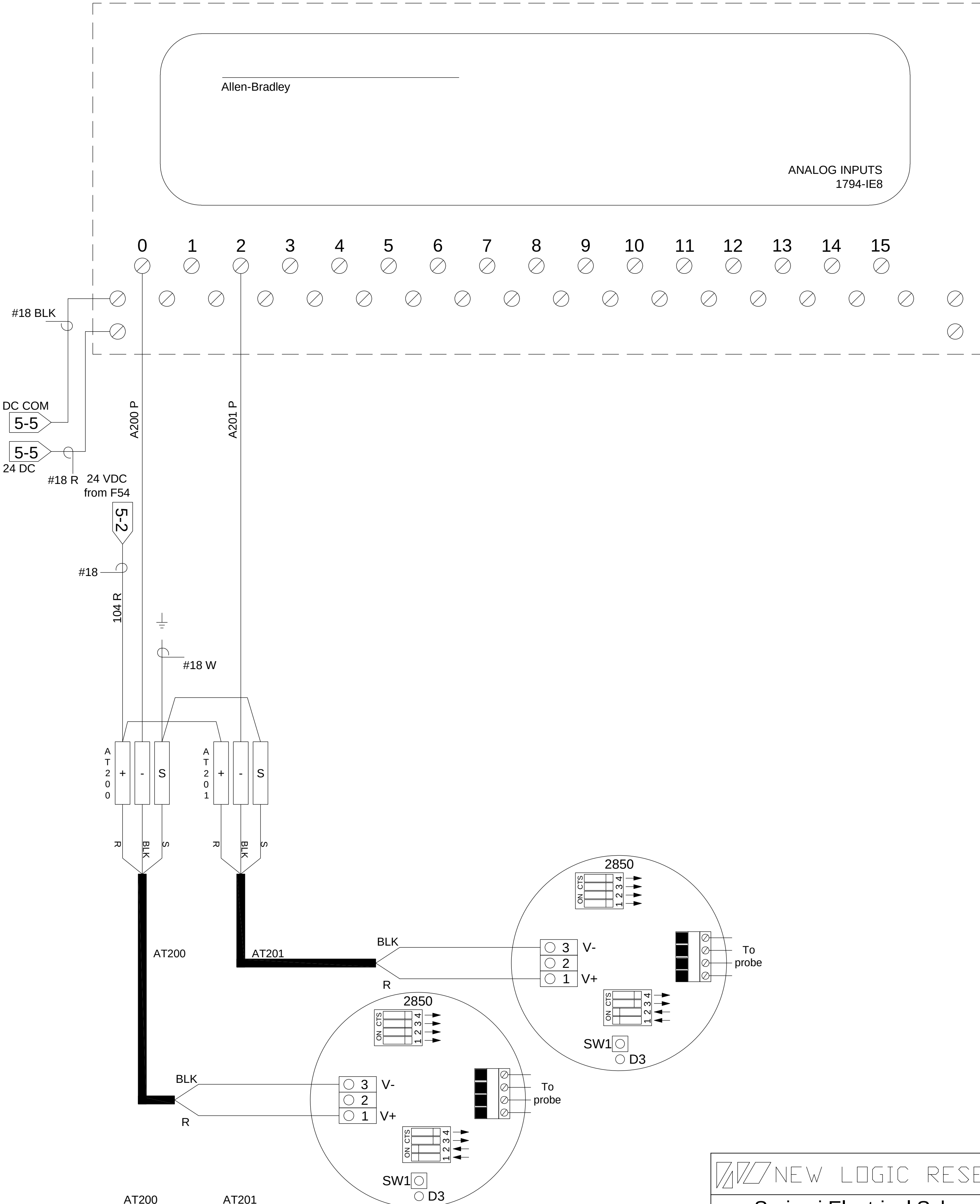
NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 2AI

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-5	iEL 4-440-60-ac SDL	
PROJECT: Santo Domingo Landfill-RO		SHEET 45 of 49	

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



AT200

SPIRAL FEED
CONDUCTIVITY

AT201

SPIRAL
PERMEATE
CONDUCTIVITY

NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 3AI

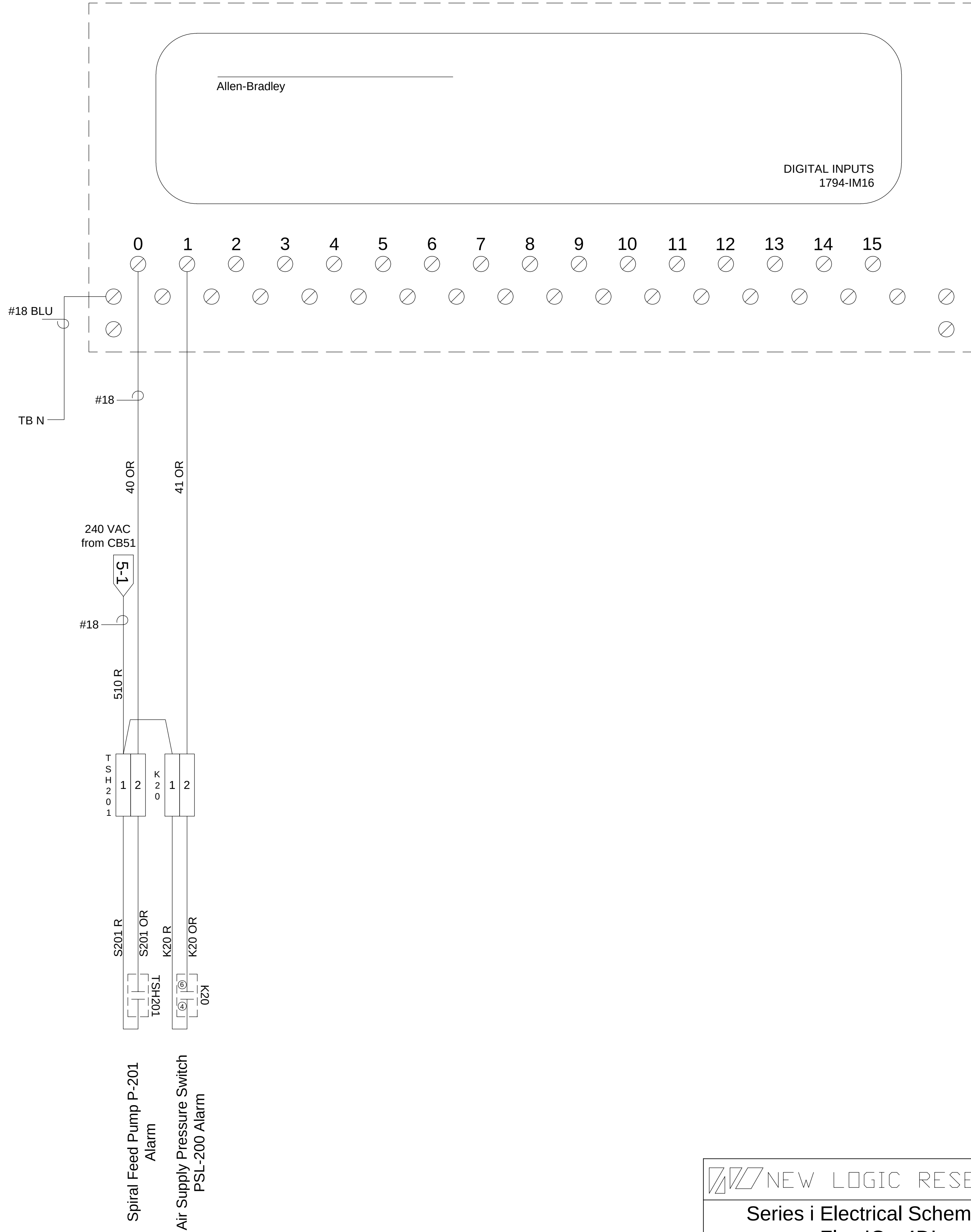
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-6	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 46 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 4DI

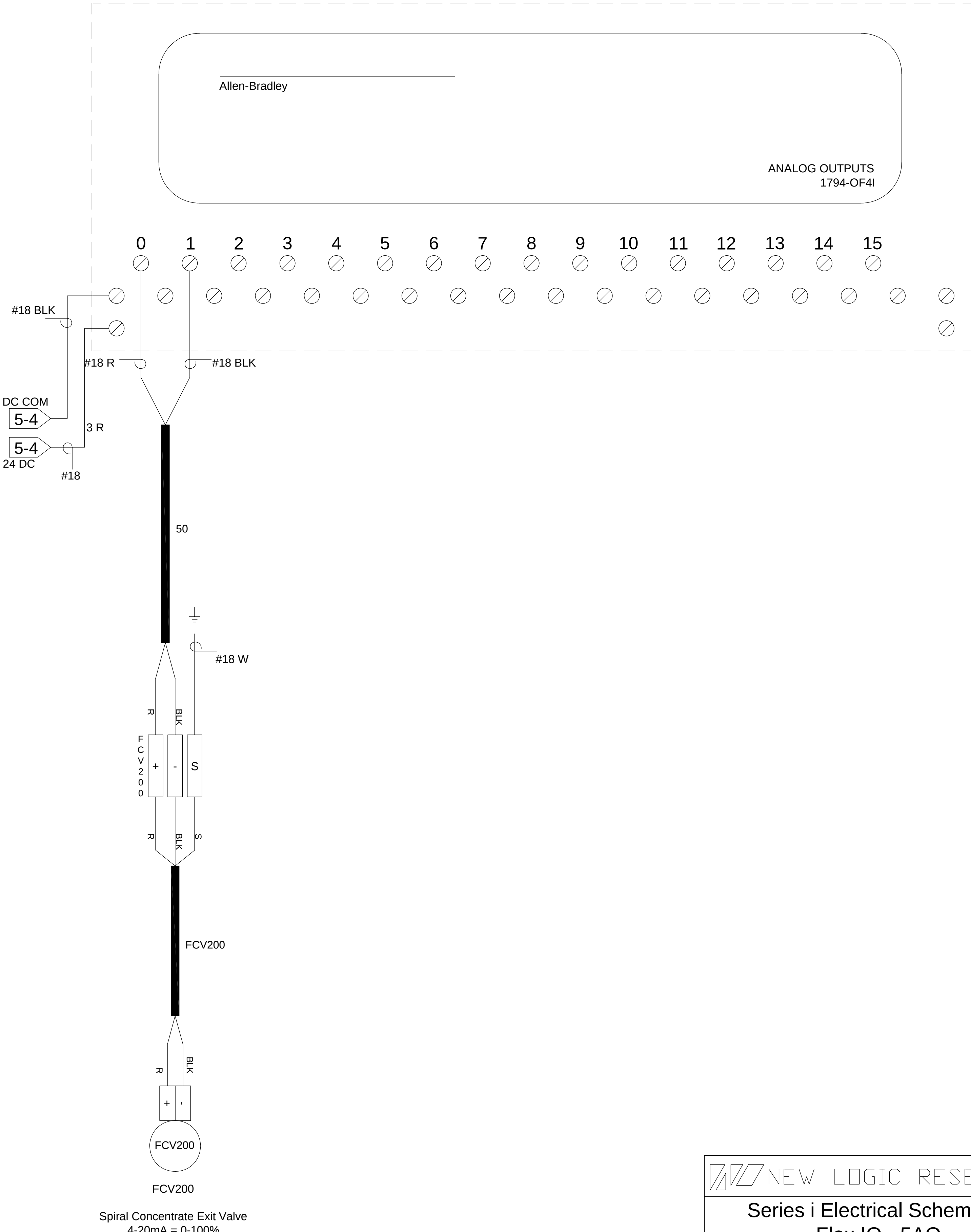
SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-7	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 47 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



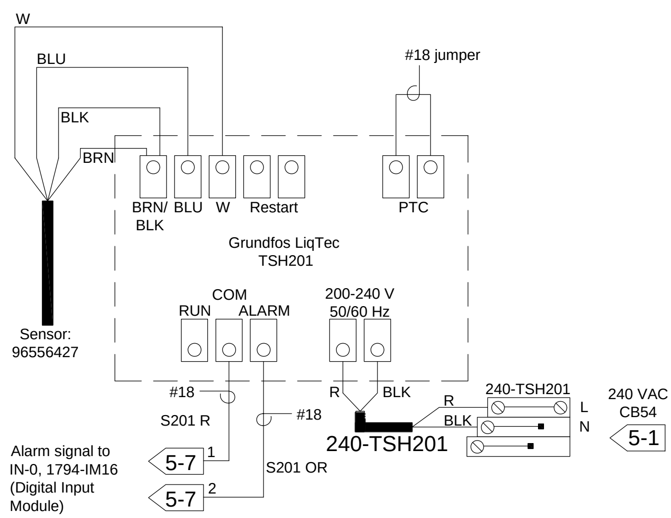
NEW LOGIC RESEARCH

Series i Electrical Schematic
Flex IO - 5AO

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-8	iEL 4-440-60-ac SDL	
PROJECT:	Santo Domingo Landfill-RO	SHEET	48 of 49

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



NEW LOGIC RESEARCH

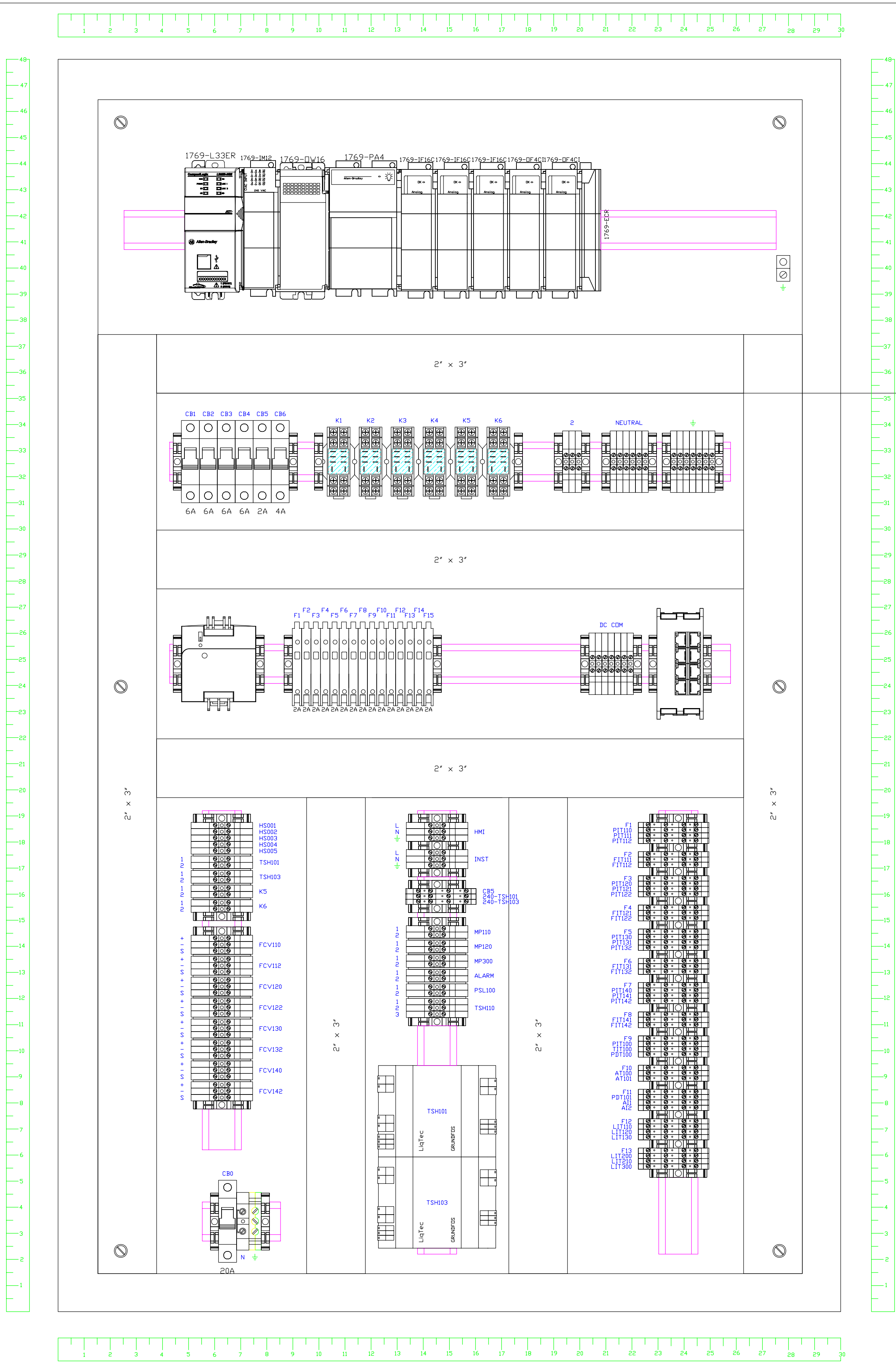
Series i Electrical Schematic
Pump Seal Transmitter

SIGNATURES		DATE
ELECTRICAL ENGINEER	KWK	11/21/13
ELECTRICAL MANAGER	EB	11/22/13

SIZE	DWG NO.	FILE	REV
A	5-9	iEL 4-440-60-ac SDL	

PROJECT: Santo Domingo Landfill-RO

SHEET 49 of 49



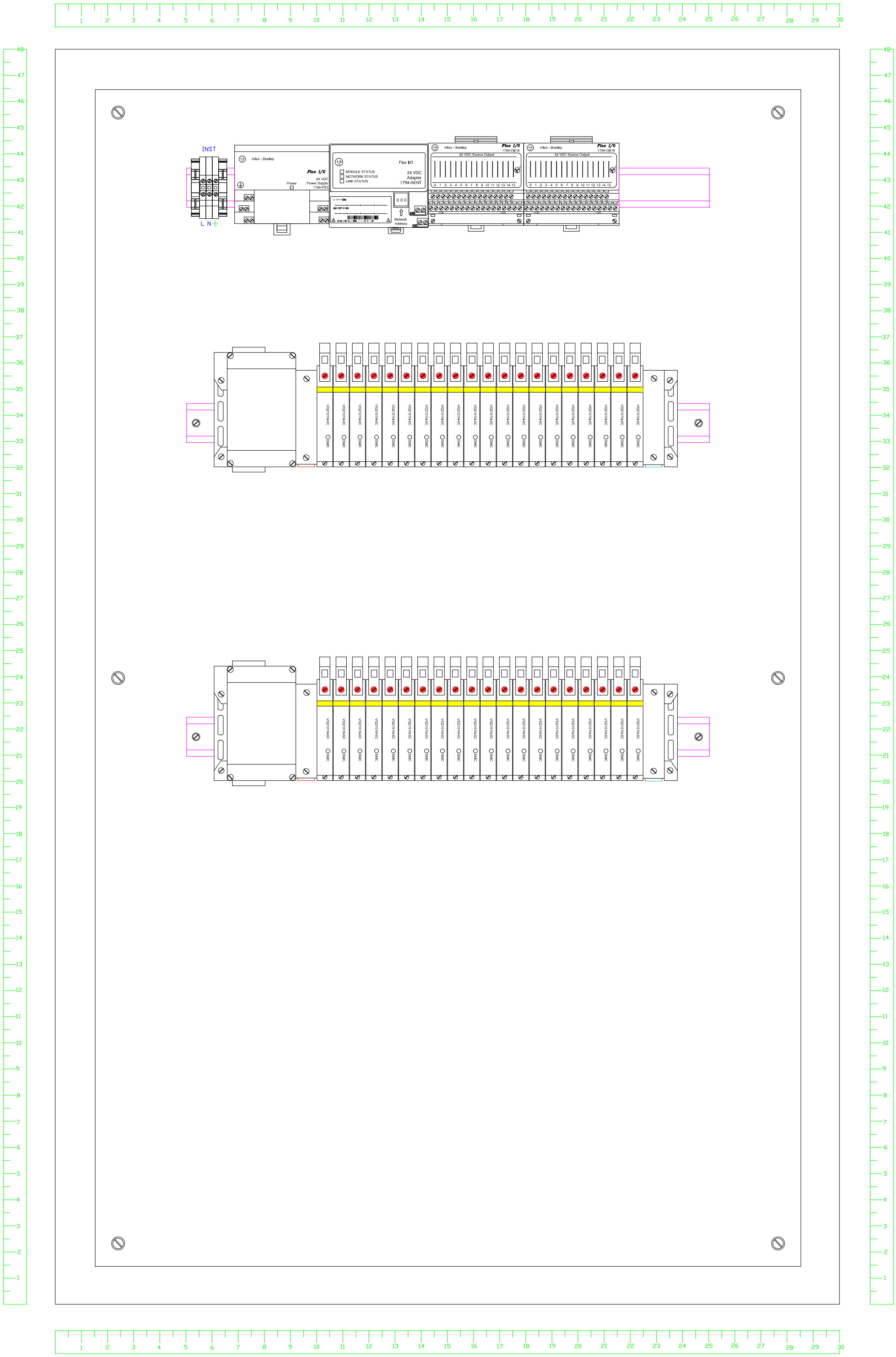
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

MAIN CONTROL ENCLOSURE

11/22/13	SDL-MCENCL	REV:



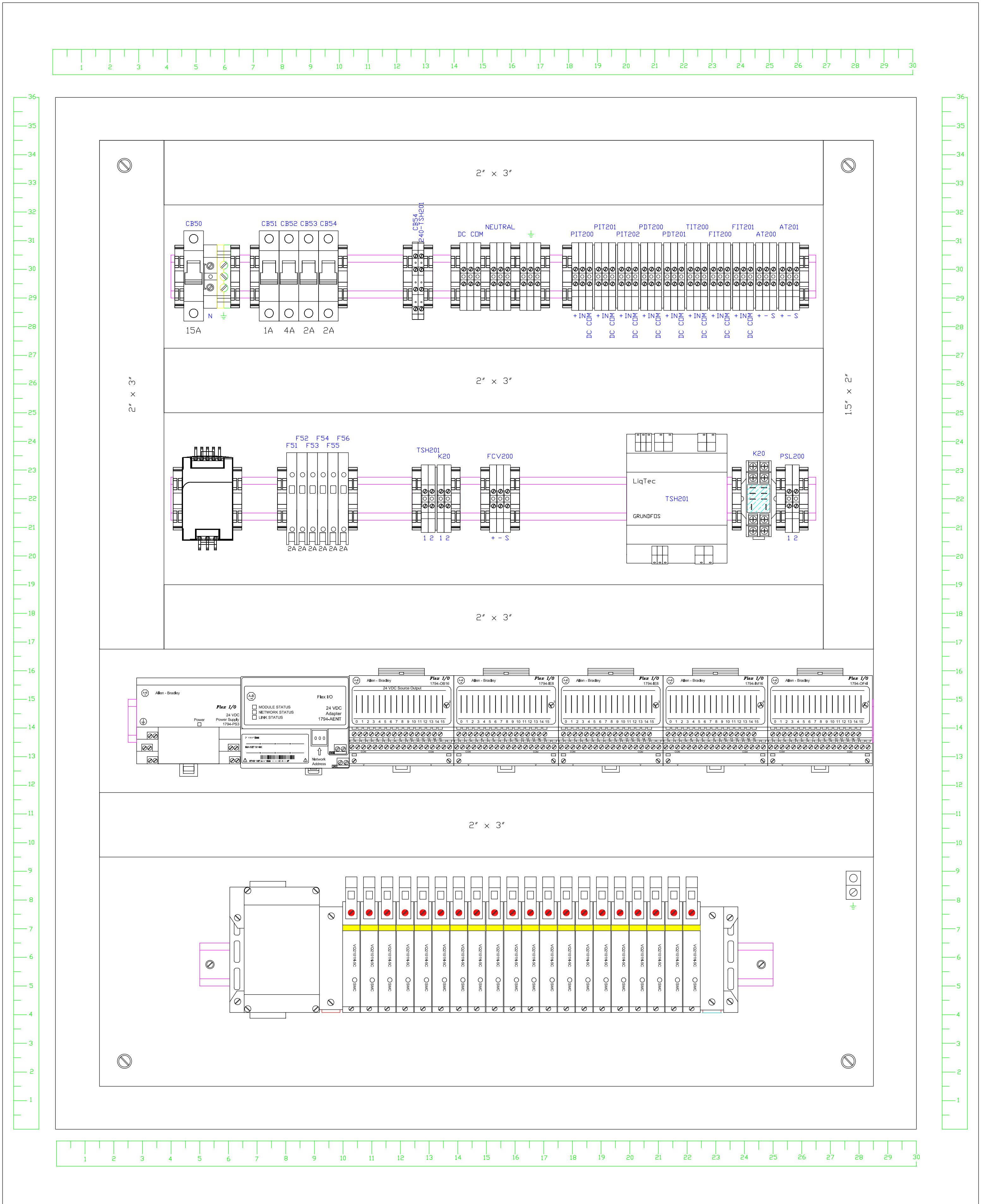
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

VALVE RACK ENCLOSURE

11/22/13 | SDL-VRENCL | REV:



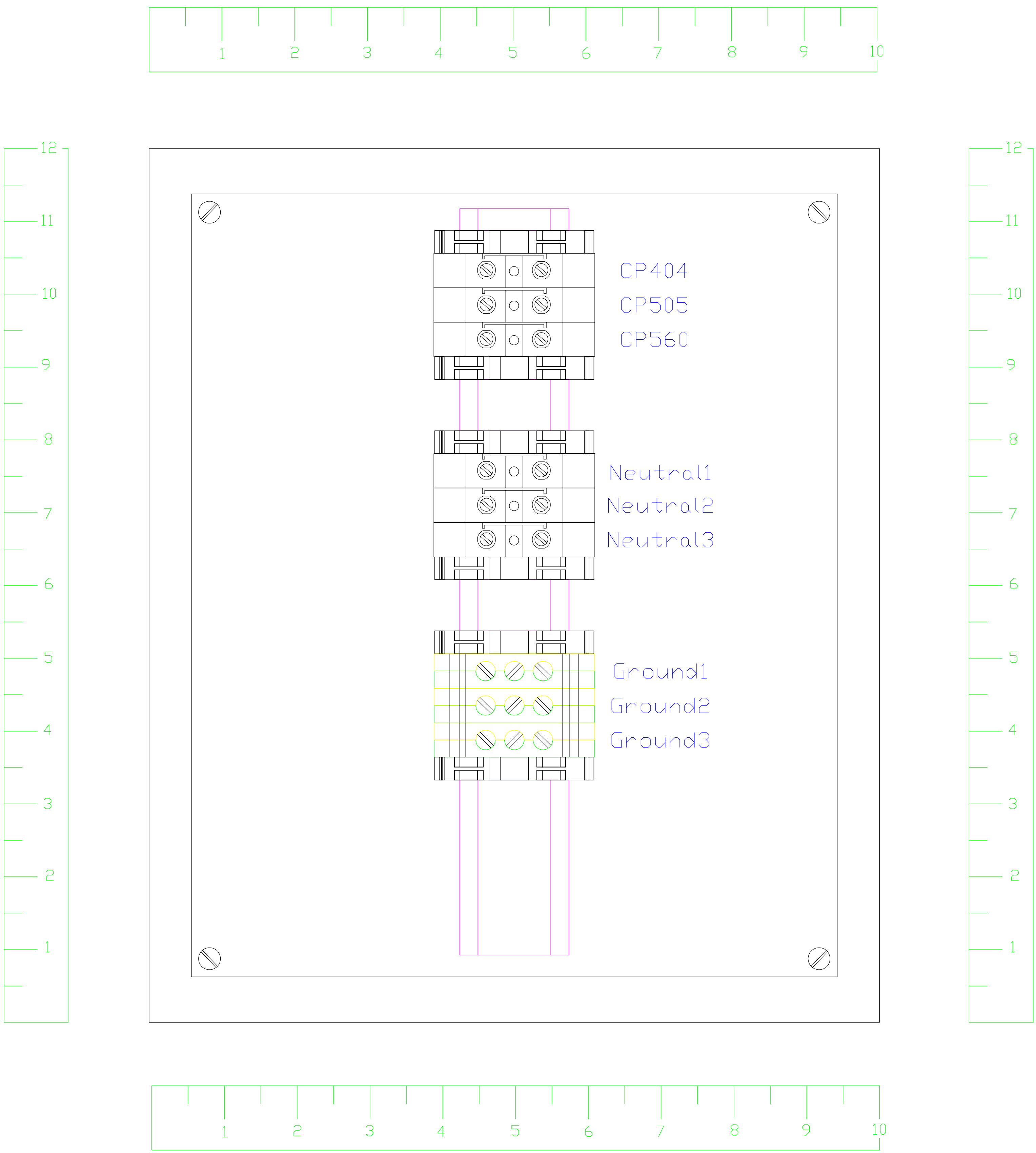
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

RO SPIRAL ENCLOSURE

11/22/13 SDL-ROENCL REV:



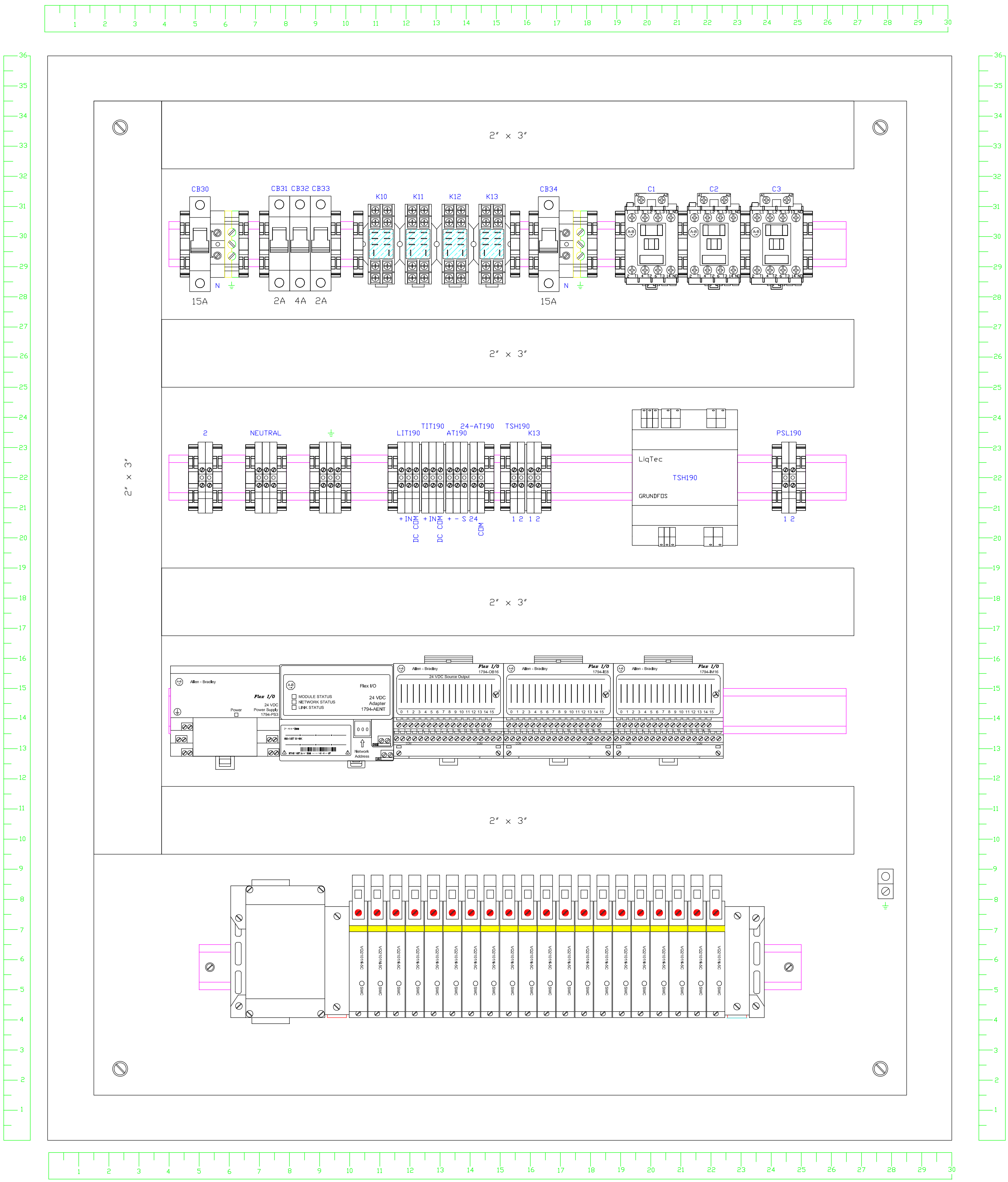
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

METERING PUMP ENCLOSURE

11/22/13	SDL-MPENCL	REV:



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

NEW LOGIC RESEARCH

SANTO DOMINGO LANDFILL

CIP ENCLOSURE

11/22/13	SDL-CIPENCL	REV:

DESCRIPTION	QTY.	PART#	MANUFACTURER

Main Enclosure

48"h x 30"w x 10" deep Enclosure	1	A48H30CLP	Hoffman
Enclosure Panel	1	A-48P30	Hoffman
2MB CompactLogix w/ EtherNet	1	1769-L33ER	Allen Bradley
240VAC Digital Input Board	1	1769-IM12	Allen Bradley
Relay Output Board	1	1769-OW16	Allen Bradley
Power Supply	1	1769-PA4	Allen Bradley
16 Single Current Analog Input Board	3	1769-IF16C	Allen Bradley
Analog Output Board	2	1769-OF4CI	Allen Bradley
CompactLogix Right End Cap	1	1769-ECR	Allen Bradley
HMI = 12"TFT, TouchScreen, DUO, 1GB 40G	1	6181P-12TPXP	Allen Bradley
FTViewSE Run Time Package 100 Display	1	9701-VWSB100AENE	Allen Bradley
8 port Unmanaged Ethernet Switch	1	1783-US08T	Allen Bradley
Ethernet Cables (pre made)	2		Comp USA
20 Amp Circuit Breaker	1	1492-SP1B200	Allen Bradley
6 Amp Circuit Breaker	4	1492-SP1B060	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	1	1492-SP1B020	Allen Bradley
DC Power Supply 100W 24VDC	1	1606-XLP100E	Allen Bradley
DC Fuse Blocks	15	1492-H4	Allen Bradley
24VDC Fuses (2A)	15	AGC-2	Buss
Relay (DPDT 24VDC coil)	2	700-HF32Z24	Allen Bradley
Relay (DPDT 240VAC coil)	4	700-HF32A2	Allen Bradley
Relay Socket	6	700-HN116	Allen Bradley
STOP Buttons	2	800H-FRXT6D4	Allen Bradley
STOP Label	2	800T-X550	Allen Bradley
Power Terminal Blocks	1	1492-J16	Allen Bradley
Ground Input Terminal Block	1	1492-JG16	Allen Bradley
Single Terminal Blocks	79	1492-J4	Allen Bradley
Terminal Block End Covers	16	1492-EBJ3	Allen Bradley
Terminal Block Anchors	45	1492-EAJ35	Allen Bradley
3 Wire Sensor Terminal Block	50	1492-WTS3	Allen Bradley
Insertion Bridge for 3 wire term. Blocks	10	1492-SJT5-20-B	Allen Bradley
Terminal Block Jumper Bars with Screws	5	1492-CJJ6-10	Allen Bradley
Terminal Block Markers	1	1492-M6X5	Allen Bradley
2" x 3" Wiring Duct, 6ft	4	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	4	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	5	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	2	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

DESCRIPTION	QTY.	PART#	MANUFACTURER

Wire Gutter

2.5" Feed-Through Type 12 Wireway (60")	2	F22W60	Hoffman
2.5" Feed-Through Type 12 Wireway (36")	2	F22W36	Hoffman
2.5" Feed-Through Type 12 Wireway (12")	2	F22W12	Hoffman
2.5" Telescoping Type 12 Wireway	1	F22WA	Hoffman
2.5" 90° Elbow	3	F22WE90	Hoffman
2.5" Tee	1	F22WT	Hoffman
2.5" Closure Plate	2	F22WP	Hoffman
2.5" Gasket	14	F22WG	Hoffman

DESCRIPTION	QTY.	PART#	MANUFACTURER
Valve Rack Enclosure			
48"h x 30"w x 10" deep Enclosure	1	A48H30CLP	Hoffman
Enclosure Panel	1	A-48P30	Hoffman
24VDC Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	2	1794-OB16	Allen Bradley
Terminal Base for Remote I/O	2	1794-TB2	Allen Bradley
20 Port Solenoid Rack	2	NL-VVC5Q2120/VQC2101	SMC
Single Terminal Blocks	3	1492-J4	Allen Bradley
Terminal Block Anchors	2	1492-EAJ35	Allen Bradley
35mm DIN Rail, 1m=3.28ft	1	199-DR1	Allen Bradley

DESCRIPTION	QTY.	PART#	MANUFACTURER
CIP Enclosure			
36"h x 30"w x 8" deep Enclosure	1	A-36H30BLP	Hoffman
Enclosure Panel	1	A36P30	Hoffman
240VAC 50/60Hz Contactor	3	100-C23KA10	Allen Bradley
Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	1	1794-OB16	Allen Bradley
16 Digital Input Module	1	1794-IM16	Allen Bradley
8 Analog Input Module	1	1794-IE8	Allen Bradley
Terminal Base for remote i/o	3	1794-TB2	Allen Bradley
15 Amp Circuit Breaker	2	1492-SP1B150	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	2	1492-SP1B020	Allen Bradley
Relay (DPDT 24VDC coil)	4	700-HF32Z24	Allen Bradley
Relay Socket	4	700-HN116	Allen Bradley
20 Port Solenoid Rack	1	NL-VVC5Q2120/VQC2101	SMC
Power Terminal Blocks	2	1492-J16	Allen Bradley
Ground Input Terminal Block	2	1492-JG16	Allen Bradley
Single Terminal Blocks	25	1492-J4	Allen Bradley
Terminal Block Anchors	24	1492-EAJ35	Allen Bradley
Terminal Block End Covers	4	1492-EBJ3	Allen Bradley
Terminal Block Jumper Bars with Screws	1	1492-CJJ6-10	Allen Bradley
2" x 3" Wiring Duct, 6ft	2	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	2	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	3	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	1	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

DESCRIPTION	QTY.	PART#	MANUFACTURER

Chemical Metering Enclosure

Enclosure	1	A1210NF	Hoffman
Enclosure Panel	1	A12P10	Hoffman
Power Terminal Blocks	6	1492-J16	Allen Bradley
Ground Input Terminal Block	3	1492-JG16	Allen Bradley
Terminal Block Anchors	6	1492-EAJ35	Allen Bradley
35mm DIN Rail, 1m=3.28ft	0.5	199-DR1	Allen Bradley

DESCRIPTION	QTY.	PART#	MANUFACTURER

RO Spiral Enclosure

36"h x 30"w x 8" deep Enclosure	1	A-36H30BLP	Hoffman
Enclosure Panel	1	A36P30	Hoffman
Power Supply	1	1794-PS3	Allen Bradley
Ethernet Adapter	1	1794-AENT	Allen Bradley
16 Digital Output Module	1	1794-OB16	Allen Bradley
16 Digital Input Module	1	1794-IM16	Allen Bradley
4 Analog Output Module	1	1794-OF4I	Allen Bradley
8 Analog Input Module	2	1794-IE8	Allen Bradley
Terminal Base for remote i/o	5	1794-TB2	Allen Bradley
15 Amp Circuit Breaker	1	1492-SP1B150	Allen Bradley
4 Amp Circuit Breaker	1	1492-SP1B040	Allen Bradley
2 Amp Circuit Breaker	2	1492-SP1B020	Allen Bradley
1 Amp Circuit Breaker	1	1492-SP1B010	Allen Bradley
DC Power Supply 50W 24VDC	1	1606-XLP50E	Allen Bradley
DC Fuse Blocks	6	1492-H4	Allen Bradley
24VDC Fuses (2A)	6	AGC-2	Buss
Relay (DPDT 24VDC coil)	1	700-HF32Z24	Allen Bradley
Relay Socket	1	700-HN116	Allen Bradley
20 Port Solenoid Rack	1	NL-VVC5Q2120/VQC2101	SMC
Power Terminal Blocks	1	1492-J16	Allen Bradley
Ground Input Terminal Block	1	1492-JG16	Allen Bradley
Single Terminal Blocks	48	1492-J4	Allen Bradley
Terminal Block Anchors	23	1492-EAJ35	Allen Bradley
Terminal Block End Covers	10	1492-EBJ3	Allen Bradley
3 Wire Sensor Terminal Block	2	1492-WTS3	Allen Bradley
Terminal Block Jumper Bars with Screws	2	1492-CJJ6-10	Allen Bradley
1.5" x 2" wire duct	0.5	G1.5X2LG6	Panduit
1.5" wire duct cover	0.5	C1.5LG6	Panduit
2" x 3" Wiring Duct, 6ft	2	G2X3LG6	Panduit
2" Wiring Duct Cover, 6ft	2	C2LG6	Panduit
35mm DIN Rail, 1m=3.28ft	3	199-DR1	Allen Bradley
240VAC LiqTec Pump Seal Sensor/Transmitter	1	96556429	Grundfos
Ground Lug	1	LAMA2-14-QY	Panduit

SDL Project - VSEP I/O List						
Tag #	Description	I/O Type	Data Type	Units	Range	PLC Source
VSEP#1 Stop	VSEP #1 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch0Data
VSEP#2 Stop	VSEP #2 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch1Data
VSEP#3 Stop	VSEP #3 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch2Data
VSEP#4 Stop	VSEP #4 Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch3Data
EMG Stop	Emergency Stop Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch4Data
TSH-101	Booster Pump	DI	BOOL	1=open	0-1	Local:2:I.Ch5Data
TSH-103	Booster Pump	DI	BOOL	1=open	0-1	Local:2:I.Ch6Data
PSL-100	Air Supply Pressure Switch	DI	BOOL	1=open	0-1	Local:2:I.Ch7Data
TSH-110	Transfer Pump P-110 Alarm	DI	BOOL	1=open	0-1	Local:2:I.Ch8Data
	Spare	DI	BOOL			Local:2:I.Ch9Data
	Spare	DI	BOOL			Local:2:I.Ch10Data
	Spare	DI	BOOL			Local:2:I.Ch11Data
	Spare	DI	BOOL			Local:2:I.Ch12Data
	Spare	DI	BOOL			Local:2:I.Ch13Data
	Spare	DI	BOOL			Local:2:I.Ch14Data
	Spare	DI	BOOL			Local:2:I.Ch15Data
PIT-110	VSEP#1 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch0Data
PIT-111	VSEP#1 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch1Data
PIT-112	VSEP#1 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch2Data
FIT-111	VSEP#1 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch3Data
FIT-112	VSEP#1 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch4Data
PIT-120	VSEP#2 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch5Data
PIT-121	VSEP#2 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch6Data
PIT-122	VSEP#2 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch7Data
FIT-121	VSEP#2 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch8Data
FIT-122	VSEP#2 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch9Data
PIT-130	VSEP#3 Feed Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch10Data
PIT-131	VSEP#3 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch11Data
PIT-132	VSEP#3 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:3:I.Ch12Data
FIT-131	VSEP#3 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:3:I.Ch13Data
FIT-132	VSEP#3 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:3:I.Ch14Data
	Spare	AI	32 bit REAL			Local:3:I.Ch15Data
PIT-140	VSEP#4 Feed Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch0Data
PIT-141	VSEP#4 Permeate Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch1Data
PIT-142	VSEP#4 Concentrate Line	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch2Data
FIT-141	VSEP#4 Permeate Return Line	AI	32 bit REAL	m3/hr	0-22.7 m3/hr	Local:4:I.Ch3Data
FIT-142	VSEP#4 Concentrate Return Line	AI	32 bit REAL	m3/hr	0-11.36 m3/hr	Local:4:I.Ch4Data
PIT-100	System Feed Pressure	AI	32 bit REAL	psi	0-1000	Local:4:I.Ch5Data
TIT-100	System Feed Temperature	AI	32 bit REAL	ºC	0-100	Local:4:I.Ch6Data
PDT-100	Feed Differential Pressure IN	AI	32 bit REAL	psi	0-145	Local:4:I.Ch7Data
AT-100	Feed Conductivity	AI	32 bit REAL	µS	0-200000	Local:4:I.Ch8Data
AT-101	VSEP Permeate Conductivity	AI	32 bit REAL	µS	0-10000	Local:4:I.Ch9Data
PDT-101	Feed Differential Pressure OUT	AI	32 bit REAL	psi	0-145	Local:4:I.Ch10Data
LIT-110	VSEP Feed Tank T-110 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch11Data
LIT-120	Concentrate Tank T-120 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch12Data
LIT-130	Permeate Tank T-130 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch13Data
LIT-140	Hot Water Tank T-140 Level	AI	32 bit REAL	%	0-100	Local:4:I.Ch14Data
	Spare	AI	32 bit REAL			Local:4:I.Ch15Data
FCV-110	VSEP #1 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch0Data
FCV-112	VSEP #1 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch1Data
FCV-120	VSEP #2 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch2Data
FCV-122	VSEP #2 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch3Data
FCV-130	VSEP #3 Feed Inlet	AO	32 bit REAL	%	0-100	Local:6:I.Ch4Data
FCV-132	VSEP #3 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:6:I.Ch5Data
FCV-140	VSEP #4 Feed Inlet	AO	32 bit REAL	%	0-100	Local:7:O.Ch0Data
FCV-142	VSEP #4 Concentrate Exit	AO	32 bit REAL	%	0-100	Local:7:O.Ch1Data
	Spare	AO	32 bit REAL			Local:7:O.Ch2Data
	Spare	AO	32 bit REAL			Local:7:O.Ch3Data
	Spare	AO	32 bit REAL			Local:7:O.Ch4Data
	Spare	AO	32 bit REAL			Local:7:O.Ch5Data

M-P110	Tank T-110 Transfer Pump Motor P-110	DO	BOOL	1=open	0-1	Local:8:O.Ch0Data
M-P120	Concentrate Tank T-120 Transfer Pump Motor	DO	BOOL	1=open	0-1	Local:8:O.Ch1Data
M-P130	Permeate Tank T-130 Transfer Pump Motor	DO	BOOL	1=open	0-1	Local:8:O.Ch2Data
	Alarm	DO	BOOL	1=open	0-1	Local:8:O.Ch3Data
XV-001	Permeate To Hot Water Tank T-140 Valve	DO	BOOL	1=open	0-2	Local:8:O.Ch4Data
XV-002	Permeate to River Valve	DO	BOOL	1=open	0-3	Local:8:O.Ch5Data
	Spare	DO	BOOL			Local:8:O.Ch6Data
	Spare	DO	BOOL			Local:8:O.Ch7Data
	Spare	DO	BOOL			Local:8:O.Ch8Data
	Spare	DO	BOOL			Local:8:O.Ch9Data
	Spare	DO	BOOL			Local:8:O.Ch10Data
	Spare	DO	BOOL			Local:8:O.Ch11Data
	Spare	DO	BOOL			Local:8:O.Ch12Data
	Spare	DO	BOOL			Local:8:O.Ch13Data
	Spare	DO	BOOL			Local:8:O.Ch14Data
	Spare	DO	BOOL			Local:8:O.Ch15Data
XV-100	Hot Water Inlet to Bag Filter	DO	BOOL	1=open	0-1	Enet:1:O. Data.0
XV-101	Feed Inlet to Bag Filter	DO	BOOL	1=open	0-1	Enet:1:O. Data.1
XV-102	Feed to Header	DO	BOOL	1=open	0-1	Enet:1:O. Data.2
XV-103	Feed to Header	DO	BOOL	1=open	0-1	Enet:1:O. Data.3
XV-105	Permeate to VSEP Feed Tank, T-110	DO	BOOL	1=open	0-1	Enet:1:O. Data.4
XV-106	Permeate to Holding Tank, T-130	DO	BOOL	1=open	0-1	Enet:1:O. Data.5
XV-107	Concentrate to VSEP Feed Tank, T-110	DO	BOOL	1=open	0-1	Enet:1:O. Data.6
XV-108	Concentrate to Reject Tank, T-120	DO	BOOL	1=open	0-1	Enet:1:O. Data.7
XV-110	CIP Feed to VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.8
XV-111	CIP Permeate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.9
XV-112	Permeate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.10
XV-113	CIP Concentrate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.11
XV-114	Concentrate From VSEP #1	DO	BOOL	1=open	0-1	Enet:1:O. Data.12
XV-120	CIP Feed to VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.13
XV-121	CIP Permeate From VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.14
XV-122	Permeate From VSEP #2	DO	BOOL	1=open	0-1	Enet:1:O. Data.15
XV-123	CIP Concentrate From VSEP #2	DO	BOOL	1=open	0-1	Enet:2:O. Data.0
XV-124	Concentrate From VSEP #2	DO	BOOL	1=open	0-1	Enet:2:O. Data.1
XV-130	CIP Feed to VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.2
XV-131	CIP Permeate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.3
XV-132	Permeate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.4
XV-133	CIP Concentrate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.5
XV-134	Concentrate From VSEP #3	DO	BOOL	1=open	0-1	Enet:2:O. Data.6
XV-140	CIP Feed to VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.7
XV-141	CIP Permeate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.8
XV-142	Permeate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.9
XV-143	CIP Concentrate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.10
XV-144	Concentrate From VSEP #4	DO	BOOL	1=open	0-1	Enet:2:O. Data.11
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.12
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.13
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.14
	Spare	DO	BOOL	1=open	0-1	Enet:2:O. Data.15
XV-190	Hot Water to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.0
XV-191	Hot Water to VSEP	DO	BOOL	1=open	0-1	Enet:3:O. Data.1
XV-192	CIP Tank to Drain	DO	BOOL	1=open	0-1	Enet:3:O. Data.2
XV-193	CIP Tank to Pump	DO	BOOL	1=open	0-1	Enet:3:O. Data.3
XV-194	CIP Pump to Feed Header	DO	BOOL	1=open	0-1	Enet:3:O. Data.4
XV-195	Feed Bypass to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.5
XV-196	Permeate to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.6
XV-197	Permeate to Destination	DO	BOOL	1=open	0-1	Enet:3:O. Data.7
XV-198	Concentrate to CIP Tank	DO	BOOL	1=open	0-1	Enet:3:O. Data.8
XV-199	Concentrate to Destination	DO	BOOL	1=open	0-1	Enet:3:O. Data.9
	Spare	DO	BOOL			Enet:3:O. Data.10
	Spare	DO	BOOL			Enet:3:O. Data.11
	Spare	DO	BOOL			Enet:3:O. Data.12
CP-404	Run Chemical Pump CP-404	DO	BOOL	1=open	0-1	Enet:3:O. Data.13
CP-505	Run Chemical Pump CP-505	DO	BOOL	1=open	0-1	Enet:3:O. Data.14
CP-560	Run Chemical Pump CP-560	DO	BOOL	1=open	0-1	Enet:3:O. Data.15

LIT-190	VSEP CIP Tank, T-190 Level	AI	32 bit REAL	%	0-100	Enet:4:I. Data.0
	Spare	AI	32 bit REAL			Enet:4:I. Data.1
TIT-190	CIP Feed Temperature	AI	32 bit REAL	°C	0-100	Enet:4:I. Data.2
	Spare	AI	32 bit REAL			Enet:4:I. Data.3
AT-190	CIP Feed pH	AI	32 bit REAL	pH	0-14	Enet:4:I. Data.4
	Spare	AI	32 bit REAL			Enet:4:I. Data.5
	Spare	AI	32 bit REAL			Enet:4:I. Data.6
	Spare	AI	32 bit REAL			Enet:4:I. Data.7
	Spare	AI	32 bit REAL			Enet:4:I. Data.8
	Spare	AI	32 bit REAL			Enet:4:I. Data.9
	Spare	AI	32 bit REAL			Enet:4:I. Data.10
	Spare	AI	32 bit REAL			Enet:4:I. Data.11
	Spare	AI	32 bit REAL			Enet:4:I. Data.12
	Spare	AI	32 bit REAL			Enet:4:I. Data.13
	Spare	AI	32 bit REAL			Enet:4:I. Data.14
	Spare	AI	32 bit REAL			Enet:4:I. Data.15
TSH-190	CIP Feed Pump P-190 Alarm	DI	BOOL	1=open	0-1	Enet:5:I. Data.0
PSL-190	Air Supply Pressure Switch	DI	BOOL	1=open	0-1	Enet:5:I. Data.1
	Spare	DI	BOOL			Enet:5:I. Data.2
	Spare	DI	BOOL			Enet:5:I. Data.3
	Spare	DI	BOOL			Enet:5:I. Data.4
	Spare	DI	BOOL			Enet:5:I. Data.5
	Spare	DI	BOOL			Enet:5:I. Data.6
	Spare	DI	BOOL			Enet:5:I. Data.7
	Spare	DI	BOOL			Enet:5:I. Data.8
	Spare	DI	BOOL			Enet:5:I. Data.9
	Spare	DI	BOOL			Enet:5:I. Data.10
	Spare	DI	BOOL			Enet:5:I. Data.11
	Spare	DI	BOOL			Enet:5:I. Data.12
	Spare	DI	BOOL			Enet:5:I. Data.13
	Spare	DI	BOOL			Enet:5:I. Data.14
	Spare	DI	BOOL			Enet:5:I. Data.15
	Spare	DO	BOOL			Enet:6:O. Data.9
	Spare	DO	BOOL			Enet:6:O. Data.10
	Spare	DO	BOOL			Enet:6:O. Data.11
	Spare	DO	BOOL			Enet:6:O. Data.12
	Spare	DO	BOOL			Enet:6:O. Data.13
	Spare	DO	BOOL			Enet:6:O. Data.14
	Spare	DO	BOOL			Enet:6:O. Data.15

5.1 VSEP Control Strategy

Customer: SDL Santo Domingo Landfill
Location: Santo Domingo de los Tsachilas, Quito, Ecuador
Feed Material: Landfill Leachate
Membrane: ESPA & LFC3-LD

5.1.1] Process Description:

Santo Domingo Landfill has several leachate ponds. The waste from Santo Domnigo City and surrounding towns is collected and sent to this landfill. They have reached the maximum capacity of these ponds and have reached a point where they need to treat this leachate to reduce the levels in the pond and make some space for future leachate storage.

The leachate will be pre-screened and then will be sent for a first pass through VSEP ESPA System. Permeate generated from VSEP system will be further processed through 2nd stage Spiral RO system, to ensure good quality. The concentrate from both, first and second stage will be sent back to the leachate ponds.

Process feed conditions:

Process Flow Rate	166-333 m3/day
Process Temperature:	Ambient
Process Pressure:	450 psi (500 max)
Operating Method:	Single Pass – Constant Flow

First stage will comprise of a four unit expandable VSEP system with an initial one 84" ESPA VSEP modules (1400SF each). The second stage will comprise of six 40”x8” LFC-3LD (1200SF per module) RO Spiral modules.

The system will come with many options for control methods and will be fitted with a local control that can communicate with the main plant logic system. The system will include a PLC and will be run locally. The VSEP and Spiral systems will include the membrane modules, the control and pumping skid with integral CIP functions, and a chemical metering pump station for delivery of NLR cleaners for automated cleaning functions.

5.1.2] Filtration Overview:

All feed material must be pre-screened before being processed through the VSEP unit. During each filtration mode, the system will data log appropriate information such as, temperature, pressure, flow rates etc.

The program will consist of two filtration methods as described below. The process will continue until the system is prompted to shut down for an alarm or for flushing/cleaning. These prompts include feed and destination tank levels, permeate flux reaches lowest acceptable level or permeate quality reaches the highest acceptable level. Timed quick hot water flushes could be used intermittently during processing to increase time between full chemical cleanings.

1. **Single Pass – Constant Flow:** For this project, the goal is to generate high volumes of permeate and reduce the levels in the ponds rather than achieving an *immediate* high % recovery. For this purpose it is recommended to run the system in Single Pass – Constant Flow mode. Here the feed material is processed through the VSEP system and permeate and concentrate are sent to their appropriate destinations. Notice that the concentrate will be sent back to the leachate ponds and not back to the VSEP batch feed tank. So in theory the ponds are viewed as large batch feed tanks which will get concentrated over longer periods of time. This means that the feed material will always remain consistent and thus will allow having good stable permeate flow rates as well as good quality. The frequency of full chemical cleaning cycle will be reduced compared to other filtration methods.

   With Batch filtration, the feed material will become concentrated towards the end of the batch, since the concentrate stream is recycled back to the batch feed tank. Thus the feed exposed to the membranes towards the end of the batch will consist of high TSD/TSS level. This will affect the performance in terms of flux. A decline in flux is noticed as the batch progresses and hence the flux rate will not be consistent throughout the whole batch.

2. **Batch Concentration:** For Batch Concentration the system will start with a full tank and remove up to ~75% (in accordance with desired recovery) of the volume of the tank as permeate while sending the VSEP concentrate back to the feed tank. Once the feed tank has had ~75% or more of the volume removed, the concentrate will be diverted to its destination tank, T-120, until the feed tank is empty. Then the VSEP system will flush via Hot Water In line from VSEP feed pump skid (automated function) while the feed tank, T-110 is being refilled simultaneously. It is possible to have two batch feed tanks so that when one feed tank is being processed, the second tank will be refilled simultaneously and sit in standby mode once filled. This will allow for minimum downtime.

   Since the feed to the VSEP will vary greatly with different beginning % solids levels, the concentration level achieved will also need to vary. The system would be run at a recovery value that yields optimum concentration and filtrate that is of an equivalent quality. This optimum concentration level would represent the maximum optimum concentration that the VSEP can produce clean filtrate reliably and at a good throughput rate. Maximum volume reduction is desired, however, there is a converse relationship between concentration level and permeate quality. If the concentration level goes too high, permeate quality may begin to worsen due to the set rejection of the membrane. While controlling the VSEP system, we will need to control the % volume reduction as well as the permeate quality and both will be monitored and used for determining the ending concentration level. Permeate quality may be monitored by conductivity readings and volume reduction may be monitored by percent recovery.

5.1.3] Filtration Set Points:

Configurable set points included are:

i) Feed Pressure_– The VSEP will be run at constant pressure, which will mean that the pressure through the VSEP will be held constant. At all times during filtration, the feed pump will adjust by means of a VFD to hold a specific pressure.

ii) Concentrate Flow – A specified % recovery is required across VSEP in order to achieve the end result desired. In addition, a minimum amount of fluid velocity is required in each filter pack to prevent "Dead Zones", "Cake Formation", "Gel Pockets", and other feed material inconsistencies which can affect flux and also potentially cause plugging of the filter pack. These two controlling parameters are in conflict if the % recovery demand is so high that the concentrate flow rate would fall below the minimum safe rate. For most filter packs this minimum safe number is ~ 2 GPM, (~7.5L/min) per tray within the last section of trays in the filter pack.

iii) Start/Stop Control – starting from the Local Control Panel; if the system is ready, the operator may start the system by using the green START button at the local control panel. For the system to be ready, the following conditions must be met.

- The system must be set for Filtration Mode
- The latching STOP button must be released or pulled out
- The system must not be stopped by an alarm
- The Feed Tank must be more than 10% full
- Destination tanks 90% or less full.
-

iv) Vibration Amplitude – Before VSEP vibration can be started, the minimum safe operating pressure must be achieved. The reason for this is that pressure holding the membrane pressed against the steel tray which supports it is required to counteract the effects of side to side movement during vibration. Without sufficient pressure holding the membrane down, it could shred or come apart as it is tugged from side to side. It is this unique relationship between pressure and vibration, which is the key to the VSEP technology. The key pressure, which is calculated, is the "Trans-Membrane" pressure, which is calculated by subtracting the permeate pressure from the concentrate pressure. This value should be at least 35 psi (241 kPa). The feed and concentrate pressure must also meet a minimum of 40 psi (276 kPa). Lastly a set point for a percentage of total VFD speed is able to be manipulated to adjust the amplitude of vibration. This number can vary between feed materials, filter packs, and VSEP frames; but is usually in the range of 20-30%.

v) Tank Level Control – The VSEP system will be configured to run continuously and it will assume that the proper feed has been delivered to the VSEP feed tank. The VSEP will monitor the feed tank level and run after getting a start command based on a configurable tank level set point. The program will include an interlock, so that, the system cannot be started with an empty tank. For the purposes of design, the tank level must read greater than 5%. If the system starts up on a nearly dry tank, the feed pumps will spin up to try to reach the pressure setpoint. If it is unable to do so within a timed interval, the system will shut down on alarm and would self-initiate an ALARM FLUSH after a brief pause for operator intervention. This flush will be done for a timed interval using hot water via the hot water inlet to the feed pump.

The display will flash a warning when the tank level is 5% about the low-level set point. This warning will allow the operator to intervene. Once the tank level reaches low level, the system will flush with hot water through the feed pump with pressure and vibration without stopping. This low tank level set point will be configurable and should be high enough to prevent cavitation of the feed pump.

vi) Auto-Fill VSEP Batch Feed Tank – There will be one EQ Tank, T-100 and one VSEP Batch Feed Tank, T-110. Both will have Level Transmitters, which will be hardwired to VSEP PLC. There will be "dead band" ranges for T-110 which will allow for this auto-fill function. These dead band configurable set points will be: *full tank level, stop tank level.* A transfer pump will be between the two tanks which will allow to transfer material from T-100 to T-110. At the beginning of the process the level in VSEP Batch Feed Tank, T-110 will be empty which will be read by VSEP PLC. Upon reading this 0% (empty tank level), the VSEP PLC will turn on P-110 and will start to transfer material from T-100 into T-110. Once the tank level reaches a configurable *full tank level* set point the transfer pump will stop and the VSEP system will start to process feed material from this tank. Once the tank reaches *stop tank level*, there will be a 5min hot water flush and simultaneously P-110 will turn on to transfer material from T-100 to T-110. The filtration will commence again once appropriate tank level has been reached.

5.1.4] Filtration Automation:

Automation includes:

i. Feed Pressure PID – The control system will monitor the feed pressure as a single input and the feed pump will hunt to hold the specified pressure setpoint. Other pressure readings such as concentrate and trans-membrane pressure may vary during operation, but the feed pump will hold feed pressure constant. The pressure set point will be configurable.

ii. Concentrate Flow PID – The control of the Concentrate Valve will be done using a Flow Control PID loop with a subroutine for cycling of the valve. The control variable for the PID loop is the flow measurement from the concentrate flow meter. The process variable is the concentrate valve position. (0-100% Open) The operating flow set point of 20 GPM (dependant on filter pack design) is entered on the Filtration Mode Set point's screen. When the pump is started, the valve is immediately positioned to the minimum allowed position, of 30%. From there, the PID function begins to position the valve to achieve the flow rate set point. The feed pump is ramped up slowly, so the valve will open rapidly at first and then close down as the feed flow rises. Tuning the PID parameters is done on the PID FEED FLOW screen.

iii. Auto Vibrate – When the system is in filtration mode, and the auto vibrate button is enabled, vibration will be started once the pressure setpoints have been reached. When vibration starts, the drive motor goes to a pre-set speed. This pre-set speed is equal to the Minimum Frequency setpoint configured in the drive motor VFD. After a timed interval, (~15 seconds), the speed is increased slowly to the desired setpoint which produces 1/2" amplitude at the base of the filter pack. In order to change the amplitude, the frequency speed setpoint must be changed. In order to protect the equipment, a maximum allowable frequency parameter is used. This would prevent amplitude greater than 7/8" peak to peak. Both amplitude set points need to be manually set up for the first time based on visual inspection of vibrational amplitude stickers affixed to the Filter Pack. Vibration continues until a stop command is received or the pressure falls below the set points. Note that the set point will change based on new filter packs, new feed materials, hot bearing oil, as the weight/bearing friction would change the properties of motor loading at the same speed set point.

5.1.5] Filtration Start Up:

Prior to start up in Filtration Mode, a flush cycle must have been completed. This may have occurred from an Auto Flush, Alarm Flush, CIP Flush, or an intentional Manual Flush. Such low pressure purging will insure that the filter pack is clear of obstructions and all the air is purged out, (the filter pack is full). **Using high pressure on an empty filter pack can delaminate the membrane trays.** Air pockets can lead to membrane failure during vibration due to lack of Trans-Membrane pressure for the affected area. Also, by using this method, initiating filtration mode introduces concentrated feed slurry, which will be diluted upon entry to the filter pack and thus allows for a smooth transition into filtration.
VSEP Filtration Sequence of Events:

- With the system in STANDBY MODE and with no active alarm conditions, the operator first selects FILTRATION MODE and sets the feed pressure, concentrate flow and start/stop batch feed tank level. Then presses the start button.

- Upon the start command signal, the Feed Pump ramps up slowly to the Feed Pressure Set point. Several other sequences are occurring simultaneously, so the ramp speed must be slow. The concentrate flow control valve will modulate and try to hold 20 GPM (dependant on filter pack design). Until the system gets optimized, permeate and concentrate are re-circulated back to the feed tank.

- As the Trans-Membrane Pressure, (Concentrate Pressure - Permeate Pressure) passes 35 psi, the VSEP drive motor starts and ramps up quickly to “Pre-Vibration” speed, which is a drive frequency that will produce 1/8" amplitude on the filter pack.

- After a timed interval, the drive motor ramps up slowly to “Vibration” speed that would equate to 1/2” amplitude.

- After full vibration and a concentrate flow rate of about 20 GPM, all valves on the system orient to send permeate and concentrate to their destination tanks.

- End of batch will be indicated once the tank level reaches end of batch level set point. There will be a 5minute end of batch flush.

5.1.6] Flush Overview:

It is extremely important to flush the filter pack when ever the VSEP stops in order to remove waste water from the filter pack, as the foulants can form a cake layer at the membrane surface hence plugging the filter pack. There are two modes of flushing as stated below:

i) Manual CIP Flush Mode:

<u>General Description</u>

This operating mode is used to manually flush the Filter Pack. It is different than the Alarm Flush and Auto Flush, which are performed automatically. During a Manual CIP Flush cycle, hot water is sent via CIP pump to the Filter Pack with permeate and concentrate going to the reclaim drain sewer.

<u>Sequence of Events - Manual Hot Water Flush</u>

- The system operator sets the system for CIP FLUSH MODE and modifies any set points as needed. The machine must already be stopped.

- The system operator selects Flush mode from the Status screen.

- The automatic Hot Water In valve opens to feed hot water directly to the CIP pump ahead of the filter pack.

- The valves orient for a Flush operation so that the system sends concentrate and permeate to the drain. The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset concentrate flow rate. (no less than 8 gpm, 20 gpm is preferable)

- The Feed Pump ramps up slowly to the Feed Pressure Set point, ~50 psi, (345 kpa).

- The concentrate flow control valve will modulate and try to hold the set point

- As the Trans-Membrane Pressure, (Concentrate Pressure - Permeate Pressure) passes 30 psi, (207 kpa), the VSEP drive motor starts and ramps up quickly to “Pre-Vibration” speed. After a timed interval, the drive motor ramps up slowly to “Vibration” speed, which would equate to 3/4” amplitude.

- ❖ This flushing operation will continue until timed interval has expired. Then, the vibration and feed pump will stop and the CIP skid valves will close

Note: In order to repeat the entire procedure above or if the procedure needs to be interrupted or to repeat the cycle, the operator should change the operation mode from FLUSH MODE to another mode, (OFF-LINE would be best) and then back to FLUSH MODE.

ii) Auto Flush Mode:

General Description

These operating modes flush the Filter Pack directly from CIP Skid, or through the Feed Pump Skid, depending on the type of flush. This sequence will be initiated automatically when the VSEP is stopped by an Alarm Shutdown condition, a low or high tank level condition, or by timed interval set point.

Alarm Shut Down Flush

Alarms are the most important part of the VSEP PLC. They cause the whole system to stop completely. If the alarms are working properly, the filter pack will be protected against errors in other parts of the program, against most common sensor failures as well as most operator errors. Set point ranges for the alarms are configurable. Some examples of common alarms include:

VSEP Alarms

(Triggered only in Filtration Mode, filter pack is flushed with water through CIP pump)
High Feed Pressure.
High Concentrate Pressure.
High Permeate Pressure.
Low Feed Pressure.
Low Minimum Trans-Membrane Pressure
High Differential Pressure
Low Permeate Flow
High Permeate Flow
Low Concentrate Flow
High Concentrate Flow
Feed Pressure Without Vibration.
Vibration Drive Fault
High Vibration Drive Motor Load.
High Permeate Conductivity

System Shutdown Alarms

(Triggered only in Filtration Mode, filter packs are flushed with water through feed pumps)
Low Feed Temperature
High Feed Temperature
Feed Pump Failure
Low Feed Tank Level
High Permeate Tank Level
High Bag Filter Differential Pressure

Cleaning Cycle Alarms

(Cycle stops and waits for operator, filter pack is not flushed as CIP skid is not available)
Low CIP Temperature
High CIP Temperature
Low CIP pH
High CIP pH
High CIP Tank Level
High Feed Conductivity

After an Alarm Shut Down, the VSEP is isolated by valve orientation and drive motors will stop. Then there is a system pause, which would allow the system operator enough time to cancel the automatic flush, which is about to occur. After a time out, the flush sequence commences.

The valves orient so that the unit is flushed from the CIP and the concentrate and permeate are sent to the drain; (system alarms will shutdown all filter packs and flush through the VSEP Feed Pump Skid, during this type of flush the permeate and concentrate will be sent to final destination tank). This condition continues for a pre-set timed interval or until the operator presses the STOP button.

The system will remain in Shut Down Mode and cannot be restarted until the operator clears the Alarm and the condition which caused it.

Note: If CIP skid is in cleaning, a VSEP can not be flushed until the CIP system is free.

Timed Auto Flush
Based on timers it is possible to flush all VSEPs through the feed pump skid. This has been known to lengthen time between cleanings. Also after system has been flushed it will go back online for filtration.

Auto End of Batch Flush
The VSEP's will be flushed automatically with hot water once a filtration batch has been completed.

5.1.7] Cleaning (CIP) Mode:

i) Auto Cleaning (CIP) Mode:

General Description:
This operating mode is used to clean the Filter Pack by using a FLUSH – WASH (acidic) - CIP RINSE- FLUSH – WASH (caustic) - CIP RINSE - FLUSH cycle. During a FLUSH cycle, hot water is pumped through the Filter Pack with permeate and concentrate going to the drain for a set timed interval. During a WASH cycle, the contents of the CIP tank, which would include chemical cleaners, are recirculated back to the CIP tank for a timed interval. After completion the contents are drained. During a CIP RINSE the contents from the CIP Tank are drained and the tank is rinsed with water and prepared for second wash cycle.

Timed Cleaning:

At a configurable preset timed interval of operation in filtration mode, a single VSEP will be pulled off line automatically and will initiate a cleaning cycle via CIP skid. Simultaneously the other VSEP's will continue operating in filtration mode. This can happen after a certain number of hours of operation have elapsed.

Sequence of Events:

- The automatic Hot Water In valve opens to fill the CIP tank if it is not already full.
- At the same time, the NLR 404 chemical tote metering pump begins to dispense the appropriate amount of chemical cleaner into the CIP tank. This would be done by configuring a time set point that would allow the proper amount of cleaner to be transferred from the tote to the tank. (setpoints optimized by field service engineer during installation)
- Once the VSEP is taken off line, the valves orient for a hot water FLUSH operation. The Hot Water is sent to the VSEP unit to be cleaned directly from the Hot Water In valve on the feed pump inlet. Permeate and the concentrate are sent to the drain.

The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset concentrate flow rate. (20 gpm is preferable).

- ❖ After a timed interval of flushing, the system orients to initiate a WASH (acidic) cycle from the CIP tank. Once the system is ready, valves orient and the feed pump begins to ramp up. Constant Pressure Control will be used as an operating method with a set point of 50 psi and a sub routine for a PID Loop controlling the concentrate flow at 20 gpm. If the permeate rate is high and the system is not capable of reaching 50 psi, the pump will ramp until the feed flow is 80 gpm or to full speed whichever comes first.

- ❖ If safe transmembrane pressure is achieved (30 psi), the vibration will initiate to the "Pre-Vibration speed equal to 1/8" amplitude and then after a timed interval increase to 1/2" amplitude speed

- ❖ At the beginning of the cleaning cycle, valves orient so the concentrate will be sent to the drain until the CIP tank level reaches 75% to avoid reintroducing most foulants into the cleaning solution. When the tank level is reached the concentrate valves switch so that they are recirculated back to the CIP tank.

- ❖ This operation then continues for a configurable timed period, (45 minutes). Then after this timed interval, the concentrate valve again switches back to a drain destination. This then reduces the CIP tank volume and this step continues until the tank is drawn down when the feed pump and vibration will stop

- ❖ Once the Wash cycle is complete and the feed pump and vibration have stopped, the CIP Feed valve to the VSEP will close and the Hot Water In valve to the CIP tank opens for a short CIP RINSE. The CIP tank drain valve opens automatically after a configurable timed setpoint and will purge out any chemical cleaner contents or foulants from the CIP Tank. The configurable set point may vary depending on how foamy the cleaners are.

- ❖ Then the same procedure repeats for the second FLUSH – WASH (caustic) – CIP RINSE – FLUSH cycles.

- ❖ After final flushing, the CIP valves close, and the valves to the process feed pump open. The VSEP will resume back to filtration mode.

Note: In order to repeat the entire procedure above or if the procedure needs to be interrupted and starting over is desired, the operator should reset the system by changing the operation mode from CLEANING MODE to another mode, (OFF-LINE would be best) and then back to CLEANING MODE.

Note: Vibration is desirable during rinsing or cleaning as it will prevent re-fouling by foulants dislodged from the cleaning. Cleaning and rinsing are generally more effective with vibration; however, vibration is not mandatory.

<u>Operating Set points for Auto CIP Mode:</u>

- TANK LEVEL FOR WASH: The % level at which the CIP filling operation is done
- TANK LEVEL FOR RECIRC: The CIP tank is level at which permeate and concentrate are sent back to the tank
- WASH LENGTH: The time period for the wash cycle is set here
- FLUSH LENGTH: Can be used to set timed interval of rinsing, or let the tank draw down
- FEED PRESSURE: Operating pressure for wash and flush cycles.
- CONCENTRATE FLOW RATE: Concentrate flow rate for during the cleaning cycle to provide adequate cross flow and efficient cleaning.

ii) Manual Cleaning (CIP) Mode:

General Description

- Manual Cleaning Mode follows the same principle as Auto Cleaning Mode, as stated above. After stopping the system due to low permeate fluxes or high permeate conductivity, the system operator sets the system for manual CLEANING MODE and modifies any setpoints as needed. Then the operator presses the start button to initiate. The sequence of events are the same as above. However at the end of the cleaning cycle the system will stop and go to Standby Mode.

Note: It is assumed that daily hot water flushing will work well in some cases. However it is estimated that three to four times per week, of NLR404 and NLR 505 chemical cleaning would be needed. Also is it estimated that once per month a NLR404 and NLR505 back to back cleaning would be prudent. All of this will be determined during operation and start up of the system.

RO Spiral Control Strategy

Customer: HSP Panama Landfill
Membrane: ESPA and LFC3-LD
Feed Material: Landfill Leachate
Suggested Preservatives: Water, and NLR 103

1] Filtration Overview:

The Spiral RO will be run in ***"single pass"*** mode. To maintain the ~80% recovery the exit concentrate flow control valve will be throttled. The inter stage tanks before (feed tank) and ahead (permeate/concentrate destination tanks) of the Spiral RO will be monitored. If these tanks get down to a configurable low/high level set point, it will automatically stop the RO skid pumps and a manual flush will have to take place.

Flushes and cleaning cycles are available for Spiral RO skid, but they need to be made manually.

2] Controls Parameters:

Included in your system are three main control parameters consisting of Permeate Flow rate, % Recovery, and Cross Flow Control. These control parameters consist of configurable set points.

i) Permeate Flow Control - The RO Spiral system will be run at constant filtrate flow, which will mean that the pressure through the RO Spiral units will vary depending on the degree of fouling with time. Flow rates at each unit would gradually decrease as the membrane fouls, and the VFDs on the feed pumps will speed up or down so that the end result would meet the design configurable permeate flow set point.

   Because of variations in the VSEP Permeate tank level (spiral feed tank) are likely to occur, tweaking of the constant Permeate Flow set point will be done automatically based on feed tank level in order to maintain a continuous operation and avoid frequent starting and stopping of the system which would safeguard against possible damage to the pumps. Unless the tank is below Low Level, RO Spiral system will initiate the Filtrate Flow Control and try to pace itself with tank level. Many variables will affect the performance of each spiral unit. The actual GFD is only an estimate, different membranes may foul at different rates, actual achieved % Recovery across unit may vary slightly, and many other factors will produce actual flow rates which vary both up and down from the original estimates. The estimated calculations are considered nominal flow rates. For this reason, the RO Spiral system will need to be tuned or adjusted to create a balance, which is optimum. Also see Note-1 and 2 below.

ii) Volumetric % Recovery – In order to accomplish the ending % recovery of permeate, a material balance between feed, permeate, and concentrate must be maintained at a fixed ratio. Flow rates at each RO Spiral would gradually decrease as the membrane fouls. Permeate flow as a percentage of feed flow will be calculated and the concentrate from the spiral system will be throttled by means of a flow control valve so that the end result would meet the design set point for % Recovery. The % Recovery target value is a configurable set point. The current design basis calls for a %Recovery of about 85% recovered as permeate and the remaining reject volume will be about 6gpm.

iii) Cross Flow Control: The Spiral RO system needs to have a constant cross flow to ensure minimum fouling. Cross flow will help keep the feed material homogenous and flowing, prevent plugging, fouling and thus reduce cleaning frequency.

3] Filtration Mode:

i) Concentrate Valve Control: Included in the program are two main control methods for the Concentrate Valve.

1. Valve Always Open - The valve is opened to a set position during start up of the system. Concentrate flow may vary.
2. Concentration Ratio - The valve throttles flow to maintain a constant concentration ratio in accordance with % recovery.

The concentrate flow control valve will follow a Flow Control PID loop with a subroutine for holding a flow set point during start up. The control variable for the PID loop is the flow measurement from the concentrate flow meter. The process variable is the concentrate valve position (0-100% Open). Once the feed pumps have ramped up and the desired permeate flow has been stabilized, the % recovery function takes over which will calculate the concentration ratio. The PLC program will scan the Feed Flow, (which in this case is equal to the Permeate flow plus the Concentrate flow), and adjust the concentrate control valve to hold set amount of flow. The PID function begins to throttle the valve to achieve the % Recovery set point.

ii) Feed Pump Control: The spiral feed pumps will be controlled via a means of a VFD control and will try to reach a configurable Start up Feed Pressure. Once this pressure has been achieved the pumps will be ramped accordingly in order to achieve a set Permeate Flow Rate. The flow rate will vary during the operation especially as the material becomes more viscous during concentration. The control system will monitor the permeate flow rate as a single input and the feed pumps will hunt to hold the specific configurable flow rate set point.

iii) Start/Stop Control: starting from the Local Control Panel, if the system is ready, the operator may start the system by using the START button at the local control panel. For the system to be ready, the following conditions must be met.

- System Manual Valves must be correctly orientated for Filtration.
- The system must be set for Filtration Mode.
- The latching STOP button must be released or pulled out.
- The system must not be stopped by an alarm.
- The Feed Tank must be more than 20% full (configurable set point).

Once the number of passes have been optimized the conductivity meter located on the permeate line can be used in correlation to determine the final permeate quality.

4] Filtration Start-up:

Sequence of Events

1. Upon the start command signal, the system checks the feed tank level and verifies appropriate level to start pumps.
2. Upon the start command signal, the Feed Pump(s) ramp up slowly to the configurable Feed Pressure Set point.
3. VFD's will adjust the pump speed to try to hold a specific permeate flow set point.
4. The % Recovery Mode will take over (throttling the exit concentrate valve), once the concentrate recycle flow rate has been achieved and the permeate flow has been stabilized along with operating pressure. The system will run until the PLC receives a stop command.

5] Flush Overview:

Two modes of flushes are available as described below:

iii) Auto Flush Mode:

General Description

This operating mode flushes the spiral membrane modules directly from the hot water inlet to the feed pump. During this sequence the flush water is pumped directly into the spiral system where the inlet valves to the feed pump switch over from feed to hot water. Permeate and concentrate valves orient to go to appropriate destinations.

This type of flush would occur if the destination tanks are full, the feed tank is below 5% or during an alarm shutdown condition

Sequence of Events – Auto Alarm Flush Mode

1. After an Alarm Shut Down, the drive motor and feed pump will stop. Then there is a system pause, which would allow the system operator enough time to cancel the automatic flush, which is about to occur. After a time out, the flush sequence commences.

2. The valves orient so that permeate and concentrate are sent to appropriate destinations.

3. Hot water in valve opens to the feed pump. The pressure adjusts to 50 psi and the concentrate flow is trimmed to a configurable set point.

4. After the Flush, the pumps will stop, valves will close and the system will standby and cannot be restarted until the operator clears the Alarm and the condition which caused it. The operator will have the option to perform a manual cleaning or to restart the batch of product.

iv) Manual Flush Mode:

General Description

Follows the same principle as Auto Flush Mode. However this operating mode is used to manually flush the spiral membrane modules.

Sequence of Events - Manual Hot Water Flush

1. The system operator sets the system for FLUSH MODE and modifies any set points as needed. The machine must already be stopped.

2. The system operator presses the START button. The valves orient and the automatic Hot Water In valve opens to feed Hot Water directly to the feed pump.

3. After the configurable flush time length the pumps will stop and the system will standby.

Operating Set points used in Auto & Manual Flush Mode

- TIME FOR FLUSH: Set the desired number of minutes for an appropriate flush cycle
- PRESSURE FOR FLUSHING: Select a number which corresponds to the desired feed pressure for Flushing (50 psi)
- FLOW RATE FOR FLUSHING: Select a number which will correspond to the Concentrate flow rate during Flushing.

6] Cleaning (CIP) Mode:

i) Auto Cleaning (CIP) Mode:

General Description

This operating mode is used to clean the Filter Pack by using a FLUSH 1 – WASH (acidic) –CIP RINSE – FLUSH 2 - WASH (caustic) – FLUSH 3 cycle. During a flush cycle, hot water is pumped through the RO membranes with the concentrate going to the drain or chemical treatment sewer. During a wash cycle, the contents of the CIP tank, which would include chemical cleaners, are recirculated back to the CIP tank for a timed interval. After completion the contents are drained and CIP tank is rinsed and prepared for second wash (caustic). During the final flush cycle, hot water is pumped through the filter pack with permeate and concentrate going to drain for a set timed interval.

For the Spiral RO skid cleanings are intended to be less frequent due to the fact that the feed is NF permeate.

Sequence of Events

- *Wash cycle preparation:*
  - The system should be stopped. The system operator sets the system for cleaning mode, modifies any set points as needed.
  - The Hot Water in valve opens to fill the CIP tank if it is not already full. Simultaneously, appropriate amount of chemical cleaner is added into the CIP tank from the chemical metering skid.
- *Flush 1:*
  - The Hot Water is sent to the spiral membranes directly from the "hot water in" valve located on the CIP skid. Permeate and concentrate valves will oriented automatically such that they are sent to the drain. The concentrate flow control valve will be set using a PID loop for flow control and maintain a preset configurable concentrate flow rate. If there is not enough water pressure, the flow control valve on the concentrate may be 100% open.
  - After a configurable flush time (typically 5mins) has elapsed, the system will stop automatically.
- *Wash Cycle (acid):*
  - The system orients to initiate a wash cycle from the CIP tank after the flush cycle. Appropriate valves are orientated automatically and permeate and concentrate lines are sent to drain until the CIP tank level reaches 75%. This is to avoid reintroducing most foulants into the cleaning solution. When the tank level is reached, permeate and concentrate valves will be switched automatically so that they are recirculated back to the CIP tank.
  - Once the system is ready and started, the pump begins to ramp up. Constant Pressure Control will be used as an operating method with a set point of 50 psi and a sub routine for a PID Loop controlling a preset configurable concentrate flow.
  - This operation then continues for a configurable timed period, (typically 30-45 minutes). Then after this timed interval, the concentrate valve orients to drain, thus reducing the CIP tank volume. This step continues until the tank is drawn down.
- *CIP Rinse:*
  - Once the Wash cycle is complete and the pump has stopped, and once the CIP tank is drained, the CIP Feed valve to the spiral will close and the Hot Water In valve to the CIP tank opens to purge chemicals and cleaners out of the CIP tank. The CIP tank drain

valve opens automatically for a configurable timed set point. The configurable time set point may vary depending on how foamy the cleaners are.

- *Flush 2:*
  - Follows the same principle as flush 1 cycle, however for a longer period of time (typically 10mins). Since that this rinse is between the two wash cycles, it is important to make sure that if not all, most of the previous chemical cleaner has been purged out of the system.

- *Wash Cycle (caustic):*
  - Follows the same principle as the acid wash cycle. However a caustic cleaner will be used in this wash instead of an acid cleaner.

- *Flush 3:*
  - Follows the same principle as previous flushes. The configurable flush time is set to about 5mins.

Note: Periodically it may be necessary to perform repeated cleanings, so the number of wash cycles is not limited and can be repeated as needed.

i) Manual Cleaning (CIP) Mode:

General Description

Manual Cleaning Mode follows the same principle as Auto Cleaning Mode, as stated above. After stopping the system due to low permeate fluxes or high permeate conductivity, the system operator sets the system for manual CLEANING MODE and modifies any set points as needed. Then the operator presses the start button to initiate the operation. The sequence of events are the same as above. However at the end of the cleaning cycle the system will stop and go to Standby Mode.

Operating Set points used in Cleaning Mode:

- TANK LEVEL FOR WASH: The % level at which the CIP filling operation is done
- TANK LEVEL FOR RECIRC: The CIP tank is level at which permeate and concentrate are sent back to the tank
- WASH LENGTH: The time period for the wash cycle is set here
- FLUSH LENGTH: Can be used to set timed interval of rinsing, or let the tank draw down
- FEED PRESSURE: Operating pressure for wash and flush cycles.
- CONCENTRATE FLOW RATE: Concentrate flow rate for during the cleaning cycle to provide adequate cross flow and efficient cleaning.

Note: It is assumed that daily hot water flushing will work well in some cases. However it is estimated that 2-3 times per month, of NLR404 and NLR 505 chemical cleaning would be needed. Also is it estimated that once every couple of months a NLR404 and NLR505 back to back cleaning would be prudent. All of this will be determined during operation.

7] Alarm Conditions that trigger an Alarm:

These alarms must cause the whole system to stop completely. Alarms are the most important part of the spiral PLC program. If the alarms are working properly, the membranes will be protected against errors in other parts of the program. They will also protect against most common sensor and/or meter failures as well as most operator errors.

1. High Feed Pressure.
2. High Concentrate Pressure.
3. High Permeate Pressure.

4. Low Feed Pressure.
5. High Differential Pressure
6. Low Permeate Flow
7. High Permeate Flow
8. Low Concentrate Flow
9. High Concentrate Flow
10. Low pH (pH1).
11. High pH (pH1)
12. High Feed Temperature.
13. High Permeate Conductivity
14. High Permeate Tank Level.

SDL- Santo Domingo Landfill Project

VSEP/SPIRAL PROCESS LINE DESTINATION	STAGE-1 , 1X 84" RO VSEP			STAGE-2, S7200 Spiral		
Operation Mode	**Feed**	**Permeate**	**Concentrate**	**Feed**	**Permeate**	**Concentrate**
Normal Fitration Mode (Single Pass process)	T-110	T-200	T-120	T-200/210	On-Spec = T-300, Off-Spec = T-210	T-120
Optional Fitration Mode (Batch process)	T-110	T-200	Batch = T-110, End of Batch = T-120	T-200/210	On-Spec = T-300, Off-Spec = T-210	T-120
System Alarm, Auto, Timed and End of Batch Flushes	T-130	T-200	T-120	T-130	T-300	T-120
404 & 505 Cleaning (both cleanings go to the same place)	T-190	T-190	T-190	T-190	T-190	T-190
CIP tank drawdown (after chemical cleaning)	T-190 (from T-130)	Drain/Sump	Drain/Sump	T-190 (from T-130)	Drain/Sump	Drain/Sump
Flush CIP Tank	T-130	Drain/Sump	Drain/Sump	T-130	Drain/Sump	Drain/Sump
Cleaning Flushes (3 flushes within the chemical cleaning cycle)	T-130	T-120	T-120	T-130	T-120	T-120

Technical Summary

Filter Pack Cleaning Procedure

Customer: Relleno Sanitario Santo Domingo de los Tsachilas
Membrane: ESPA and LFC3-LD
Feed Material: Landfill Leachate
Suggested Preservatives: Water, and NLR 103

When is Cleaning needed?
The VSEP should be rinsed and then cleaned when or before the permeate rate reaches 50% of its initial stabilized flow rate value, after the flow rates are temperature and pressure corrected. It should also be cleaned before any prolonged period of inactivity. The system should also be flushed with warm water after or during any alarm shutdowns, scheduled maintenance shutdowns, or emergencies. Regular cleaning schedules will depend on the performance of each VSEP on an individual basis. The frequency of cleaning is programmable and may vary from once per day to once per month depending on actual performance to be determined during startup. The cleaning frequency will also vary between the two membranes, due to feed materials, operating conditions, and membrane life.

Hot Water Flushing Procedure: (For Flushing Only without Cleaning)
This step is completed in Flush Mode by flushing with hot water (50-60ºC) for 5 minutes sending the permeate and sending the concentrate to their destination tanks. Use a feed pressure of approximately 50 psi and amplitude of 1/2".

Optimum Cleaners:
Typically the best chemical cleaning procedure for this application is the use of NLR 404 and NLR 505 cleaners on an as needed basis. NLR 505 is a caustic cleaner containing mostly chelating agents and surfactants. Use of this cleaner will dissolve those foulants which are soluble in medium to high pH such as organics and silica. 404 is an acidic based cleaner and can be used to remove those things soluble in acid such as mineral scale. Warm water and pH adjusting are critical to the success of the cleaning.

Cleaning Procedure:
The first step is to rinse the VSEP with warm to hot water (≤60ºC) single pass to the drain for 5 minutes at low pressure directly from the hot water line to the feed pump. Please do not exceed 80 gpm. After this flush, it is useful to get water flux data on the dirty filter pack. This will help you to verify the effectiveness of the cleaning procedure upon completion. Do this by measuring the permeate rate at the end of this rinse period, (single pass without re-circulation). The VSEP concentrate flow rate should be throttled to about 20gpm (dependent of filter pack design).

For chemical cleaning, prepare a 2-3% solution of NLR 404 or NLR 505 in your CIP tank. 200 gallons of cleaning solution is preferred. After hot water rinse, start the cleaning liquid flow into the pack and divert the first 15% to the drain. Then switch to recirculation so that the concentrate and permeate lines return to the CIP skid. Recirculate in this same way for 30-60 minutes. Then drain and rinse the CIP tank and rinse the pack again with hot water 50-60ºC for 10 minutes at low pressure (50 psi).

In order to properly verify if the membrane is clean, you should return to the feed material and compare your process flux numbers. Then you would possibly be able to correlate a process flux with a clean flush flux. Keep in mind that the most important parameter is whether you get your process flow rate back. Note that this process may need to be modified depending on fouling and from time to time you may need to use an alternative cleaner or repeated cleaning to better recover the membrane. Some of this optimization will be completed during start-up but there will also be some completed later on as your membrane begins to age.

Cleaning Procedure – Santo Domingo Landfill SDL

If there are any problems with your cleaning procedure then please contact New Logic Engineering as soon as possible for advice.

Approximate Timing for Cleaning:

Cleaner Description	Volume		Temperature	Time
	GPM	Total Gallons	(°C)	(Mins)
VSEP (typically once per day)				
1. Rinsing/flush with water prior to cleaning (feed directly into the VSEP).	60	300	50-60	5
2. NLR 404 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	60	200	50-60	30-45
3. CIP Tank Rinse.	60	50	50-60	5
4. Rinsing/flushing with water between caustic and acidic cleaning. (feed directly into the VSEP).	60	600	50-60	10
5. NLR 505 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	60	200	50-60	45-60
6. CIP Tank Rinse.	60	50	50-60	5
7. Final Flush (feed directly into the VSEP).	60	300	50-60	5
Miscellaneous steps inc prep time and mixing time				*20*
Totals		**1700**		**125-155**
RO SPRIAL (typically once per week)				
1. Rinsing/flush with water prior to cleaning (feed directly into the VSEP).	80	400	50-60	5
2. NLR 404 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	80	200	50-60	60
3. CIP Tank Rinse	60	50	50-60	5
4. Rinsing/flushing with water between caustic and acidic cleaning. (Feed directly into the VSEP).	80	800	50-60	10
5. NLR 505 clean (Fill up CIP tank and make an acidic cleaning solution. Drain first 15% of concentrate and recirculate the rest). Record pH and temperature of cleaning solution.	80	200	50-60	60
6. CIP Tank Rinse.	60	50	50-60	5
7. Final Flush (feed directly into the VSEP).	80	400	50-60	5
Miscellaneous steps inc prep time and mixing time				*20*
Totals		**2100**		**170**

NEW LOGIC RESEARCH, INC.
ADVANCED FILTRATION SYSTEMS

ESPA Membrane Specifications

Membrane Performance*

	Water Flux	**35 GFD**
	Nominal Salt Rejection	**95.4%**
	Molecular Weight Cut Off	**40 Daltons**

Membrane Composition

	Membrane Polymer	**Composite Polyamide**
	Membrane Surface Charge	**Neutrally Charged**
	Backing Material	**Non-woven Polyester**
	Supplier	**Hydranautics**

Process Condition Limits

	Maximum Pressure	**600 PSI***
	Maximum Chlorine Concentration	**< 0.1 ppm**
	Maximum Operating Temperature	**60°C (140°F)**
	Allowable pH Range	**2.0 to 12.0**
	Feed Particle Size Limit	**250 microns (60 mesh)**

VSEP Module Construction*

	Module Size	**84" Series I**
	Tray Spacing	**5/Inch**
	Membrane Area	**~1380 SF**
	FRP Housing Material	**8084 Vinyl Ester Resin**
	Plastic End Plates	**Polypropylene**
	Membrane Support Trays	**304 SS 18 ga**
	Diverter Support Trays	**304 SS 24 ga**
	Elastomers	**EPDM**
	Drainage Cloth	**Polypropylene "Tricot"**

***Test Conditions**: The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions: 1500 PPM $NaCl$ solution, 300psi (2.07 MPa) Applied Pressure, 77 °F (25 °C) Operating Temperature, 6.5 - 7.0 pH. The performance is based on a 0.5 sq. ft. flat sheet membrane and is an average value from multiple batch cell tests.

***Maximum Pressure & VSEP Module Construction**: Standard units can be upgraded up to 1200 PSI and constructed with compatible material for special applications and upon request.

Notice: Permeate flow for individual elements may vary ± 30 percent. Elements are shipped with a preservative solution containing glycerin and anti-biological agents. New Logic believes the information and data contained herein to be accurate and useful. The information and data are offered in good faith, but without guarantee, as conditions and methods of use of our products are beyond our control. New Logic assumes no liability for results obtained or damages incurred through the application of the presented information and data. It is the user's responsibility to determine the appropriateness of New Logic's products for the user's specific end uses. 03/16/01

Membrane Element — LFC3-LD (Low Fouling Technology)

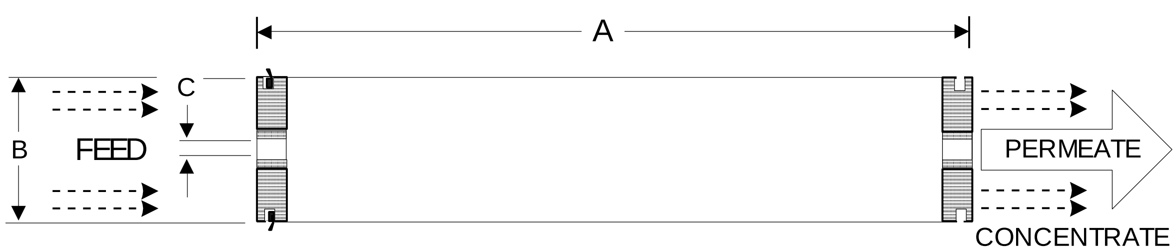
Performance:	Permeate Flow:	11,000 gpd (41.6 m^3/d)
	Salt Rejection:	99.7 % (99.5 % minimum)
Type	Configuration:	Low Fouling Spiral Wound
	Membrane Polymer:	Composite Polyamide Neutrally charged
	Membrane Active Area:	400 ft^2 (37.1m^2)
	Feed Spacer:	34 mil (0.864 mm) with biostatic agent
Application Data*	Maximum Applied Pressure:	600 psig (4.16 MPa)
	Maximum Chlorine Concentration:	< 0.1 PPM
	Maximum Operating Temperature:	113 °F (45 °C)
	pH Range, Continuous (Cleaning):	2-10 (1-12)*
	Maximum Feedwater Turbidity:	1.0 NTU
	Maximum Feedwater SDI (15 mins):	5.0
	Maximum Feed Flow:	75 GPM (17.0 m^3/h)
	Minimum Ratio of Concentrate to Permeate Flow for any Element:	5:1
	Maximum Pressure Drop for Each Element:	10 psi

***** The limitations shown here are for general use. For specific projects, operating at more conservative values may ensure the best performance and longest life of the membrane. See Hydranautics Technical Bulletins for more detail on operation limits, cleaning pH, and cleaning temperatures.

Test Conditions

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions:

1500 PPM NaCl solution
225 psi (1.55 MPa) Applied Pressure
77 °F (25 °C) Operating Temperature
15% Permeate Recovery
6.5 - 7.0 pH Range



A, inches (mm)	B, inches (mm)	C, inches (mm)	Weight, lbs. (kg)
40.0 (1016)	7.89 (200)	1.125 (28.6)	36 (16.4)

Notice: Permeate flow for individual elements may vary + or - 15 percent. Membrane active area may vary +/-4%. All membrane elements are supplied with a brine seal, interconnector, and o-rings. Elements are enclosed in a sealed polyethylene bag containing less than 1.0% sodium meta-bisulfite solution, and then packaged in a cardboard box.

Hydranautics Corporate: 401 Jones Road, Oceanside, CA 92058
1-800-CPA-PURE Phone: 760-901-2500 Fax: 760-901-2578 info@hydranautics.com

NEW LOGIC
RESEARCH, INC.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 404 - Product Information

NLR 404 is revolutionary acidic, liquid membrane cleaner formulated to effectively remove metallic-based foulants and scaling components. It is proven to target metallic salts such as iron sulfate, aluminum sulfate, barium sulfate, calcium sulfate and calcium carbonate. In addition, it can also remove dyes and inks.

It uses a non-foaming formulation that reduces the cleaning time. NLR-404 provides the cleaning performance you desire at a fraction of the time.

At the recommended cleaning concentration of 3% the solution has a pH of 3.5 making it compatible with a wide range of membranes from microfilters to reverse osmosis. This cleaner is often paired with a more alkaline cleaner in a two-stage process to successfully remove a wider range of foulants.

Successful Applications where NLR-404 is used for cleaning include:

- Landfill Leachate
- Metal Hydroxide Waste streams
- High TDS Waste streams
- Calcium Carbonate Slurries and Washdown
- Plating Wastewater
- Streams containing metallic salts
- Used in conjunction with NLR-505 for various Pulp & Paper streams

Material Safety Data Sheet

NEW LOGIC RESEARCH, INC.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: **NLR 404**
Product Number: NA
Product Synonyms: Membrane Cleaner
Chemical Family: Acidic cleaner with detergents

MSDS Number: NLR 404
Publication Date: April 2, 2009

Company Identification: **New Logic Research, Inc.**
1295 67th Street
Emeryville, CA 94608 USA
510-655-7305 (For product information)
800-424-9300 (For Transportation Emergency)
Web Site: www.vsep.com

Phone: 510-655-7305
Fax: 510-655-7307

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
WARNING! EYE IRRITANT, SKIN IRRITANT

POTENTIAL HEALTH EFFECTS
Routes of Entry: Inhalation, skin, eyes, ingestion
Chemical Interactions: Reacts with alkaline materials to form salts, and corrodes many metals.
Medical Conditions Aggravated: None known.
Human Threshold Response Data Odor Threshold: Not established Irritation Threshold: Not established

Hazard Category Classifications and Ratings

Hazard Categories:	Health	Fire	Pressure	Reactivity	Reference 49 CFR 171.8, OSHA 29 CFR 1910.1200 and SARA 302/311/312/313.
Immediate	Yes	No	No	No	
Delayed	No	No	No	No	
HMIS Hazard Ratings: Health 2 Fire 0 Instability 0 Other B (Glasses, gloves)					
NFPA 704 Hazard Rating: Health 2 Flammability 0 Reactivity 0 Special NA					
Hazard Ratings: Least 0 Slight 1 Moderate 2 High 3 Extreme 4					

Immediate (Acute) Health Effects
Inhalation Toxicity: Not expected to be toxic by inhalation.
Inhalation Irritation: Moderately irritating to the eyes, nose, throat, and lungs.
Skin Contact: Skin contact may cause minor irritation consisting of transient redness and/or swelling.
Skin Absorption: No significant adverse effects to health would be expected to occur from incidental dermal contact.
Eye Contact: Contact may cause moderate irritation consisting of transient redness, swelling, and mucous membrane discharge to the conjunctiva.
Ingestion Irritation: Irritation may result.
Ingestion Toxicity: See Sec. 11 for animal toxicological results.
Acute Target Organ Toxicity: Eyes, skin, mucous membranes, respiratory tract

Prolonged (Chronic) Health Effects
Carcinogenicity:This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product. See Sec. 11 for animal study results.
Sensitization: No sensitizing effects known.
Inhalation: No information.
Skin Contact: Repeated or prolonged dermal contact may cause defatting of skin and/or dermatitis.
Skin Absorption: No information.
Ingestion: Chronic ingestion will chelate calcium in teeth and bones, weakening them.

Chronic Target Organ Toxicity: No data.
Supplemental Health Hazard Information: No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	SARA 313	Material or Component	%	RQ#	Exposure Limits TWA*	STEL*	WEEL*
Not Listed	No	Organic Acid	<50	None	Not Established		NE

No component is listed in "Threshold and Biological Exposure Indices for 2004" from ACGIH except as noted above. Components listed in Title III Sec. 313 (EPCRA) are indicated by "Yes" above. *TWA= Time Weighted Average; STEL= Short Term Exposure Limit; WEEL= Workplace Employee Exposure Level. NE= Not Established

4. FIRST AID MEASURES

Inhalation: IF INHALED: Remove individual to fresh air. Seek medical attention.
Skin Contact: IF ON SKIN: Flush skin with water, rinse thoroughly.
Eyes: IF IN EYES: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids apart. Call a physician immediately.
Ingestion: IF SWALLOWED: Immediately drink water to dilute. Consult a physician if symptoms develop. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): Non flammable water solution.

Flammable Properties
Flash Point None
Auto Ignition Temperature: Not applicable
Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable
Fire/Explosion Hazards: Material will not ignite or burn.
Extinguishing Media: Not Applicable. Choose extinguishing media suitable for surrounding materials.
Fire Fighting Instructions: In case of fire, use fire fighting equipment appropriate to the cause of the fire.
Hazardous Combustion Products: Will produce oxides of carbon if evaporated and burned.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation
Spill Mitigation Procedures:
Air Release: Not a likely scenario, nor source of personnel hazard.
Water Release: This material is soluble in water. Contain all liquid for treatment and/or disposal. Notify all downstream users of possible contamination.
Land Release: Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, earth or commercial absorbent), then place in a chemical waste container. Decontaminate all clothing and the spill area using a detergent and flush with large amounts of water. Contain all contaminated water for disposal and/or treatment.

Additional Spill Information: Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section XIII, Disposal Considerations.

7. HANDLING AND STORAGE

Handling: Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.
Storage: Do not store in metal container.
Shelf Life Limitations: See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage: Storage in original containers is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Equipment for Routine Use of Product Respiratory Protection:
Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or aerosols are generated, wear a NIOSH approved respirator.
General protective and hygienic measures: The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.
Eyes: Use chemical goggles.
Protective Clothing Type: Impervious
Exposure Limit Data : See Section II

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Odor: None
pH (@ 25 Deg. C): Acid
Bulk Density: Not applicable
Phosphorous %: 1.16
Vapor Pressure: (@ 25 Deg. C): No data
Volatiles % by vol.: Approx. 50% water
Freezing Point: Below 0'C

Color: Water white
Molecular Weight: Not Applicable for a solution.
Solubility in Water: Completely miscible
Specific Gravity: Approx. 1.2
Vapor Density (Air = 1): Not applicable
Evaporation Rate (Water = 1)Not applicable
Boiling Point: About 105'C

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary: Stable under normal conditions.
Reactive Properties:
Sensitivity to mechanical shock: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: None known.
Chemical Incompatibility: Reacts with alkaline and caustic materials.
Hazardous Decomposition Products: Oxides of carbon, nitrogen and sulfur if burned.
Decomposition Temperature: No data
Product May Be Unstable At Temperatures Above: No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology Data are for 100% organic acid from Alfa Aesar MSDS dated 3/11/02.
Irritation of skin: Moderate: 500 mg/24 hr (rbt)
Irritation of eyes: Severe: 750 ug/24 hr (rbt)
Inhalation LC50 value: No information.
LD 50mg/kg: 5040 (mus); 6730 (rat)

Skin Irritation: This material is expected to be moderately irritating.
Eye Irritation: This material is expected to be severely irritating.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product.
Sub acute to chronic toxicity: To the best of our knowledge the acute and chronic toxicity of this material is not fully known.
Carcinogenicity: This chemical is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

12. ECOLOGICAL INFORMATION

Ecological Toxicity Values: No data.

Do not allow material to be released to the environment without proper governmental permits.

13. DISPOSAL CONSIDERATIONS

Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all local, state and federal laws.

Waste Disposal Summary: Product as made has the characteristic of corrosivity, like " Unlisted Hazardous Waste D002", RQ 100#.
Potential US EPA Waste Codes: Not applicable
Disposal Methods: As a corrosive hazardous liquid waste, it should be disposed of in accordance with local, state and federal regulations.
Components subject to land ban restrictions: No components subject to land ban restrictions.

14. TRANSPORTATION INFORMATION

Proper Shipping Name: Corrosive liquid, acidic, organic, nos, 8, UN 3265, PG III
Emergency Response Guide Number ERG 153
Labels required per 49 CFR 172.101: Corrosive
Size for "Limited quantity" per 49 CFR 173.150-.155: 1 gal. max. in 66# max. container
Reportable Quantity ("RQ") per 49 CFR172.101: None or not possible in one non-bulk package
Aircraft - Passenger: 5 L
Aircraft – Cargo: 60 L
Vessel stowage- Location: A
Vessel stowage- Other (49 CFR 176.84): 40

15. REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

UNITED STATES:
Toxic Substances Control Act (TSCA): The components of this product are listed on the TSCA Inventory of Existing Chemical Substances.
Pesticide acceptance indication: US EPA Registration Number: Not applicable
Superfund Amendments and Reauthorization Act (SARA) Title III: See Section III of this MSDS.

Hazard Categories Sections 311/312 (40 CFR 370.2):
Health: Acute
Chronic Physical: None
Emergency Planning & Community Right to Know (40 CFR 355, App. A):
Extremely Hazardous Substance Section 302 - Threshold Planning Quantity: Not applicable
State Right-to-Know Regulations Status of Ingredients: No data.

Material Safety Data Sheet

INTERNATIONAL REGULATIONS:

Canadian Environmental Protection Act: All of the components of this product are included on the Canadian Domestic Substances List (DSL)
Canadian Workplace hazardous Materials Information System (WHMIS):
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.
WHMIS Classification: Not Available

European Inventory of Existing Chemical (EINECS): All of the components of this product are included on EINECS,
DSCL (EEC) R-36/38 Irritating to eyes and skin. S-24/25 Avoid contact with skin and eyes. S-26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S-28 After contact with skin, wash immediately with plenty of water. S-37/39 Wear suitable gloves and eye/face protection.

16. OTHER INFORMATION

LABEL REQUIREMENTS: WARNING! NUISANCE DUST COULD CAUSE COMBUSTIBLE DUST EXPLOSION.

Hazardous Material Information System (HMIS):	Health	2
	Flammability	0
	Reactivity	0
	Personal Protection	B

NFPA/HMIS Definitions: 0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme
Protective Equipment: GLASSES, GLOVES

Prepared By: Paul Eigbrett (MSDS Authoring Services)
Approval Date: April 04, 2009

Product Number: NLR 404
Supersedes Date: April 14, 2004

ADDITIONAL INFORMATION:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

END OF MSDS

NEW LOGIC
RESEARCH, INC.

1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 505 - Product Information

NLR 505 is a unique blend of surfactants and chelating agents in a caustic liquid membrane cleaner. This unique cleaner targets organics, biological components, lignins, dyes and oil & grease.

The NLR-505 cleaner is usually used in a 3% concentration resulting in a pH of 11.5. It is compatible with most microfiltration, ultrafiltration, nanofiltration and reverse osmosis membranes. The formula can be customized to control the pH to within the limits of your specific membrane.

This cleaner is often paired with the NLR-404 when a more comprehensive two-stage cleaning is needed to remove a wider range of foulants. This is strategic for waste streams as they tend to contain a variety of fouling bodies.

The liquid formula is ideal for automated CIP systems with chemical dosing and allows for ease of handling.

Successful Applications where NLR-505 is used for cleaning include:

- Laundry Wastewater
- Whitewater
- Black Liquor
- Organic wastewaters
- Surface Water treatment
- Fertilizer Streams
- Used in conjunction with NLR-404 for two stage cleaning

NLR 505

Material Safety Data Sheet

NEW LOGIC RESEARCH, INC.

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: **NLR 505**
Product Number: NA
Product Synonyms: Membrane Cleaner
Chemical Family: Water solution of alkaline salts and detergents

MSDS Number: NLR 505
Publication Date: April 2, 2009

Company Identification: **New Logic Research, Inc.**
1295 67th Street
Emeryville, CA 94608 USA
510-655-7305 (For product information)
800-424-9300 (For Transportation Emergency)
Web Site: www.vsep.com

Phone: 510-655-7305
Fax: 510-655-7307

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
WARNING! EYE IRRITANT, SKIN IRRITANT

POTENTIAL HEALTH EFFECTS
Routes of Entry: Inhalation, skin, eyes, ingestion
Chemical Interactions: Contains chelator for many polyvalent metal ions.
Medical Conditions Aggravated: None known. Ingestion will chelator calcium in teeth and bones, weakening them.
Human Threshold Response Data: Odor Threshold: Not established, Irritation Threshold: Not established

Hazard Category Classifications and Ratings

Hazard Categories:	Health	Fire	Pressure	Reactivity	Reference 49 CFR 171.8, OSHA 29 CFR 1910.1200 and SARA 302/311/312/313.
Immediate	Yes	No	No	No	
Delayed	No	No	No	No	
HMIS Hazard Ratings: Health 1 Fire 0 Instability 0 Other B (Glasses, gloves)					
NFPA 704 Hazard Rating: Health 1 Flammability 0 Reactivity 0 Special NA					
Hazard Ratings: Least 0 Slight 1 Moderate 2 High 3 Extreme 4					

Immediate (Acute) Health Effects
Inhalation Toxicity: Not expected to be toxic by inhalation.
Inhalation Irritation: Moderately irritating to the eyes, nose, throat, and lungs.
Skin Contact: Skin contact may cause minor irritation consisting of transient redness and/or swelling.
Skin Absorption: No significant adverse effects to health would be expected to occur from incidental dermal contact.
Eye Contact: Contact may cause moderate irritation consisting of transient redness, swelling, and mucous membrane discharge to the conjunctiva.
Ingestion Irritation: Irritation may result. Ingestion will chelator calcium in teeth and bones, weakening them.
Ingestion Toxicity: See Sec. 11 for animal toxicological results.
Acute Target Organ Toxicity: Eyes, skin, mucous membranes, respiratory tract

Prolonged (Chronic) Health Effects
Carcinogenicity:This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product. See Sec. 11 for animal study results.
Sensitization: No sensitizing effects known.
Inhalation: No information.
Skin Contact: Repeated or prolonged dermal contact may cause defatting of skin and/or dermatitis.
Skin Absorption: No information.
Ingestion: Chronic ingestion will chelate calcium in teeth and bones, weakening them.

Chronic Target Organ Toxicity: No data.
Supplemental Health Hazard Information: No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS #	SARA 313	Material or Component	%	RQ#	Exposure Limits TWA*	STEL*	WEEL*
25155-30-0	No	Sodium dodecylbenzene sulfonate	<10	1000	Not Established		NE

Product also contains alkaline salts and non regulated detergents which may contribute to eye and skin irritation. No component is listed in "Threshold and Biological Exposure Indices for 2004" from ACGIH except as noted above. Components listed in Title III Sec. 313 (EPCRA) are indicated by "Yes" above. *TWA= Time Weighted Average; STEL= Short Term Exposure Limit; WEEL= Workplace Employee Exposure Level. NE= Not Established

4. FIRST AID MEASURES

Inhalation: IF INHALED: Remove individual to fresh air. Seek medical attention.
Skin Contact: IF ON SKIN: Flush skin with water, rinse thoroughly.
Eyes: IF IN EYES: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids apart. Call a physician immediately.
Ingestion: IF SWALLOWED: Immediately drink water to dilute. Consult a physician if symptoms develop. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): Non flammable water solution.

Flammable Properties
Flash Point None
Auto Ignition Temperature: Not applicable
Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable
Fire/Explosion Hazards: Material will not ignite or burn.
Extinguishing Media: Not Applicable. Choose extinguishing media suitable for surrounding materials.
Fire Fighting Instructions: In case of fire, use fire fighting equipment appropriate to the cause of the fire.
Hazardous Combustion Products: Will produce oxides of carbon, nitrogen and sulfur if evaporated and burned.

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation
Spill Mitigation Procedures:
Air Release: Not a likely scenario, nor source of personnel hazard.
Water Release: This material is soluble in water. Contain all liquid for treatment and/or disposal. Notify all downstream users of possible contamination.
Land Release: Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, earth or commercial absorbent), then place in a chemical waste container. Decontaminate all clothing and the spill area using a detergent and flush with large amounts of water. Contain all contaminated water for disposal and/or treatment.
Additional Spill Information: Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section XIII, Disposal Considerations.

7. HANDLING AND STORAGE

Handling: Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.
Storage: No safety restrictions.
Shelf Life Limitations: See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage: Storage in original containers is preferred.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation: General exhaust ventilation is likely to be sufficient for general worker safety and comfort.
Protective Equipment for Routine Use of Product Respiratory Protection:
Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or aerosols are generated, wear a NIOSH approved respirator.
General protective and hygienic measures: The usual precautionary measures for handling chemicals should be followed. Keep away from foodstuffs, beverages and feed. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.
Eyes: Use chemical goggles.
Protective Clothing Type: Impervious
Exposure Limit Data : See Section II

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Odor: None
pH (@ 25 Deg. C): Alkaline
Bulk Density: Not applicable
Phosphorous %: 1.94
Vapor Pressure: (@ 25 Deg. C): No data
Volatiles % by vol.: Approx. 84% water
Freezing Point: Close to 0'C
Color: Water white
Molecular Weight: Not Applicable for a solution.
Solubility in Water: Completely miscible
Specific Gravity: >1
Vapor Density (Air = 1): Not applicable
Evaporation Rate (Water = 1)Not applicable
Boiling Point: Close to 100'C

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary: Stable under normal conditions.
Reactive Properties:
Sensitivity to mechanical shock: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: None known.
Chemical Incompatibility: None known.
Hazardous Decomposition Products: Oxides of carbon, nitrogen and sulfur if burned.
Decomposition Temperature: No data
Product May Be Unstable At Temperatures Above: No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology Data:
No information found for such a dilute solution of these materials.
Irritation of skin: No information.
Irritation of eyes: No information.
Inhalation LC50 value: No information.
LD 50mg/kg: No information.

Skin Irritation: This material is expected to be slightly irritating.
Eye Irritation: This material is expected to be moderately to severely irritating.
Reproductive and Developmental Toxicity: No reproductive or developmental risk to humans is expected from exposure to this product.
Sub acute to chronic toxicity: Animal studies with EDTA salts such as herein contained have reported convulsions, weight loss, liver, kidney, urethra and bladder changes. Fetotoxicity and developmental abnormalities have also been reported from studies on animals. To the best of our knowledge the acute and chronic toxicity of this material is not fully known.
Carcinogenicity: This chemical is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP, or EPA.

12. ECOLOGICAL INFORMATION

Ecological Toxicity Values: No data.

Do not allow material to be released to the environment without proper governmental permits.

13. DISPOSAL CONSIDERATIONS

Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all local, state and federal laws.

Waste Disposal Summary: If this product becomes waste, it DOES NOT meet the criteria of a hazardous waste as defined under 40 CFR 261, in that it does not exhibit the characteristics of a hazardous waste of subpart C, nor is it listed as a hazardous waste under Subpart D.
Potential US EPA Waste Codes: Not applicable
Disposal Methods: As a non-hazardous liquid waste, it should be disposed of in accordance with local, state and federal regulations.
Components subject to land ban restrictions: No components subject to land ban restrictions.

14. TRANSPORTATION INFORMATION

Proper Shipping Name: Not Regulated
Emergency Response Guide Number: Not Applicable
Labels required per 49 CFR 172.101: None
Size for "Limited quantity" per 49 CFR 173.150-.155: Not Applicable
Reportable Quantity ("RQ") per 49 CFR172.101: None or not possible in one non-bulk package
Aircraft - Passenger: NA
Aircraft – Cargo: NA
Vessel stowage- Location: NA
Vessel stowage- Other (49 CFR 176.84): NA

15. REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

UNITED STATES:
Toxic Substances Control Act (TSCA): The components of this product are listed on the TSCA Inventory of Existing Chemical Substances.
Pesticide acceptance indication: US EPA Registration Number: Not applicable
Superfund Amendments and Reauthorization Act (SARA) Title III: See Section III of this MSDS.

Hazard Categories Sections 311/312 (40 CFR 370.2):
Health: Acute
Chronic Physical: None
Emergency Planning & Community Right to Know (40 CFR 355, App. A):
Extremely Hazardous Substance Section 302 - Threshold Planning Quantity: Not applicable
State Right-to-Know Regulations Status of Ingredients: No data.

Material Safety Data Sheet

INTERNATIONAL REGULATIONS:

Canadian Environmental Protection Act: All of the components of this product are included on the Canadian Domestic Substances List (DSL)
Canadian Workplace hazardous Materials Information System (WHMIS):
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.
WHMIS Classification: Class D-2B: Material causing other toxic effects (TOXIC).

European Inventory of Existing Chemical (EINECS): All of the componenets of this product are included on EINECS,
DSCL (EEC) R-22 Harmful if swallowed, R-37/38 Irritating to respiratory system and skin, R-41 Risk of serious damage to eyes. S-26 Incase of contact with eyes, rinse immediately with plenty of water and seek medical advice. S-29 Do not empty into drains. S-36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

16. OTHER INFORMATION

LABEL REQUIREMENTS: WARNING! NUISANCE DUST COULD CAUSE COMBUSTIBLE DUST EXPLOSION.

Hazardous Material Information System (HMIS):	Health	1
	Flammability	0
	Reactivity	0
	Personal Protection	B

NFPA/HMIS Definitions: 0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme
Protective Equipment: GLASSES, GLOVES

Prepared By: Paul Eigbrett (MSDS Authoring Services)
Approval Date: April 04, 2009

Product Number: NLR 505
Supersedes Date: April 15, 2004

ADDITIONAL INFORMATION:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

END OF MSDS

RE: Filter Pack Storage Procedure

Customer: SDL Santo Domingo Landfill
Membrane: ESPA
Feed Material: Landfill Leachate
Suggested Preservatives: NLR 103

MEMBRANE STORAGE SOLUTIONS

Sanitizing is only necessary for flushed or used membrane materials; new filter packs or membrane cut samples will not need any added solution as these are shipped from the Factory with Preservative.

Sanitizing as shown below is necessary for non-use of more than two weeks. Biological growth, for short term idle (less than two weeks), can be avoided by periodically flushing with warm water.

Preparing Filter Pack for Storage:

Step 1 After operation on VSEP machine, flush membrane with clean warm water at low pressure and high crossflow for at least 15 minutes. Clean the membrane as described in the cleaning procedure provided by New Logic.

Step 2 Fill the CIP tank with NLR 103 to 20% level.

Step 3 Run the machine for approximately 5 minutes and recirculate the solution as feed material and permeate the solution through the Filter Pack or Membrane. Run the machine at low pressure and high crossflow.

Step 4 Seal the Filter Pack Openings

Repeat this procedure every 60 days if temperature is below 80ºF and every 30 days if temperature is above 80ºF. For very long term storage, (4 months or more), the Filter Pack should be refrigerated or Consult New Logic for other procedures.

Note: *Drain out the NLR 103 stored in the filter pack and rinse the filter pack with fresh water before starting in filtration mode. Flushing for 20 minutes with clean water is usually enough. Flush first at low pressure with high crossflow, then, at high pressure.* ***This will be necessary for newly arriving Filter Packs from New Logic as they are shipped filled with water to preserve the membrane during shipment.***

NEW LOGIC
R E S E A R C H, I N C.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

NLR 103 - Product Information

NLR 103 is an effective preservative solution used to extend the life of membranes and prevent freezing during transportation. This solution can be utilized to maintain membrane integrity during periods where the filter is not in use. This preservative is also recommended for membranes being stored. The solution will prevent biological contamination to your membranes and allows for longer storage periods.

NEW LOGIC RESEARCH, INC.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

I. Product and Supplier Information

Product Name: NLR103
Product Number: NA
Product Synonyms: Membrane Preservative
Chemical Family or Formula: Water solution of 1,2-propanediol

MSDS Number: NLR103
Publication Date: 20-Aug-10

Supplier: New Logic Research, Inc.
1295 67th
Emeryville, CA 94608

Phone: 510-655-7305
Fax: 510-655-7307
Web page: www.vsep.com

Product Information: 510-655-7305
Transportation Emergency: 800-424-9300

II. Composition and Information on Ingredients

CAS #	SARA 313	Material or Component	%
57-55-6	No	1,2-propanediol	25
79-09-4		Propionic Acid	< 1

Toxicological Data on Ingredients: 1,2-propanediol: ORAL (LD50): Acute: 20000 mg/kg [Rat]. 22000 mg/kg [Mouse]. DERMAL (LD50): Acute: 20800 mg/kg [Rabbit].

III. Hazards Identification

Potential: Acute Health Effects:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of inhalation.
Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

IV. First Aid

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.
Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate

medical attention.
Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Serious Inhalation: Not available.
Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.
Serious Ingestion: Not available.

V. Fire Fighting Measures

Flammability Summary (OSHA):
Non flammable water solution.

Flammable Properties
Flash Point: None
Autoignition Temperature: Not applicable

Upper Flammable/Explosive Limit, % in air: Not applicable
Lower Flammable/Explosive Limit, % in air: Not applicable

Fire/Explosion Hazards: Material will not ignite or burn.

Extinguishing Media:
Not Applicable. Choose extinguishing media suitable for surrounding materials.

Fire Fighting Instructions:
In case of fire, use fire fighting equipment appropriate to the cause of the fire.

Hazardous Combustion Products:
Will produce oxides of carbon, nitrogen and sulfur if evaporated and burned.

VI. Accidental Release Measures

Personal Protection for Emergency Situations:
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

VII. Handling and Storage

Handling:
Do not take internally. Avoid contact with skin, eyes and clothing. Upon contact with skin or eyes, wash with water. Avoid breathing mist.

Storage
Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area.
Shelf Life Limitations:
See label or certificate of analysis for shelf life if applicable.
Incompatible Materials for Storage:
Storage in original containers is preferred.

VIII. Exposure Controls and Personal Protection

Engineering Controls:
Provi General exhaust ventilation is likely to be sufficient for general worker safety and comfort. respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection:
Splas Respiratory protection not normally needed since volatility and toxicity are low. If vapors, mists or Glove aerosols are generated, wear a NIOSH approved respirator.
Personal Protection in Case of a Large Spill:
Splas The usual precautionary measures for handling chemicals should be followed.
used Keep away from foodstuffs, beverages and feed.
BEFC Remove all soiled and contaminated clothing immediately.
Expo: Wash hands before breaks and at the end of work.
TWA: Avoid contact with the eyes and skin.
Consult local authorities for acceptable exposure limits.
Protective Clothing Type: Impervious

Exposure Limit Data : See Section II

IX. Physical Data

Physical State: Liquid
Color: Colorless. Clear
Odor: None
Specific Gravity: 1.02
Molecular Weight: 76.1
pH (@ 25° C): not available
Solubility in Water: Completely miscible
Bulk Density: Not applicable
Vapor Density (Air = 1): Not applicable
Vapor Pressure: (@ 25°C) No data
Evaporation Rate (Water = 1): Not applicable

Volatiles % by vol.: Approx. 75% water
Boiling Point: 214°F (100°C)
Freezing Point: -14°F (-11°C)

X. Stability and Reactivity

Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Incompatible materials, excess heat, exposure to moist air or water
Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.
Corrosivity: Non-corrosive in presence of glass.
Special Remarks on Reactivity:
Hygroscopic; keep container tightly closed. Incompatible with chloroformates, strong acids (nitric acid, hydrofluloric acid), caustics, aliphatic amines, isocyanates, strong oxidizers, acid anhydrides, silver nitrate, reducing agents.
Special Remarks on Corrosivity: Not available.
Polymerization: Will not occur.

XI. Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.
Toxicity to Animals:
Acute oral toxicity (LD50): 18500 mg/kg [Rabbit].
Acute dermal toxicity (LD50): 20800 mg/kg [Rabbit].
Chronic Effects on Humans: May cause damage to the following organs: central nervous system (CNS).
Other Toxic Effects on Humans:
Hazardous in case of ingestion.
Slightly hazardous in case of skin contact (irritant, permeator), of inhalation.
Special Remarks on Toxicity to Animals: Not available.
Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenic).
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.
Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause mild skin irritation. It may be absorbed through the skin and cause systemic effects similar to those of ingestion.
Eyes: May cause mild eye irritation with some immediate, transitory stinging, lacrimation, blepharospasm, and mild transient conjunctival hyperemia. There is no residual discomfort or injury once it is washed away.
Inhalation: May cause respiratory tract irritation.
Ingestion: It may cause gastrointestinal tract irritation. It may affect behavior/central nervous system(CNS depression, general anesthetic, convulsions, seizures, somnolence, stupor, muscle contraction or spasticity, coma), brain (changes in surface EEG), metabolism, blood (intravascular hemolysis, white blood cells - decreased neutrophil function), respiration (respiratory stimulation, chronic pulmonary edema, cyanosis), cardiovascular system(hypotension, bradycardia, arrhythmias, cardiac arrest), endocrine system (hypoglycemia), urinary system (kidneys), and liver.
Chronic Potential Health Effects:
Skin: Prolonged or repeated skin contact may cause allergic contact dermatitis.
Ingestion: Prolonged or repeated ingestion may cause hyperglycemia and may affect behavior/CNS (symptoms similar to that of acute ingestion).
Inhalation: Prolonged or repeated inhalation may affect behavior/CNS (with symptoms similar to ingestion), and spleen

XII. Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): >5000 mg/l 24 hours [Goldfish]. >10000 mg/l 48 hours [guppy]. >10000 mg/l 48 hours [water flea].
BOD5 and COD: Not available.
Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.
Special Remarks on the Products of Biodegradation: Not available.

XIII. Disposal Considerations

Care must be taken to prevent environmental contamination from the use of this material.

XIV. Transportation Information

DOT Classification: Not a DOT controlled material (United States).
Identification: Not applicable.
Special Provisions for Transport: Not applicable.

XV. Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,2-propanediol
Minnesota: 1,2-propanediol
TSCA 8(b) inventory: 1,2-propanediol

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:
WHMIS (Canada): Not controlled under WHMIS (Canada).
DSCL (EEC):
R21/22- Harmful in contact with skin
and if swallowed.
S24/25- Avoid contact with skin and eyes.
HMIS (U.S.A.):
Health Hazard: 2
Fire Hazard: 1
Reactivity: 0
Personal Protection: h
National Fire Protection Association (U.S.A.):
Health: 0
Flammability: 1
Reactivity: 0
Specific hazard:

Protective Equipment: Gloves. Lab Coat & apron. Vapor respirator. Vent hood. Be sure to use an approved/certified respriator or equivilent. Splash googles & face shield.

XVI. Additional Information

MSDS REVISION STATUS:

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. WE BELIEVE THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF ITS PUBLICATION DATE, BUT MAKE NO WARRANTY THAT IT IS. IF THIS MSDS IS MORE THAN THREE YEARS OLD YOU SHOULD CONTACT THE SUPPLIER TO MAKE CERTAIN THAT THE INFORMATION IS CURRENT.

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall New Logic be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if New Logic has been advised of the possibility of such damages.

SDL Project - Instruments Totals

Quantity	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
3	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
3	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
4	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
2	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
3	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
7	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
1	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	200-200000 uS	3-2850-52-42
3	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
1	1/4"	IFM Efector	Level Pressure Transmitter	316 SS, CoNiCr	-5-100 inH20	PN 2228
1	3/4"	GF Signet	pH Electrode	Polypro, Titanium, Viton	~	3-2726-00
1	~	GF Signet	pH Transmitter	~	0.0 to 14.0	3-9900-1
1	~	GF Signet	pH Display	~	~	3-2750-1
3	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
3	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
3	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ

39 Instruments Totals

SDL Project - Instruments List

Stage-1 VSEP RO Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TIT-100	Feed Line	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
TE-100	Feed Line	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
AE/AT-100	Feed Line	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	200-200000 uS	3-2850-52-42
PDT-100	Bag Filter Inlet	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
PDT-101	Bag Filter Outlet	1/4"	IFM Efector	DP Pressure Transmitter	316 SS, CoNiCr	0-145 psi	PN 2224
FIT-111	VSEP#1 Permeate Return Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
FIT-112	VSEP#1 Concentrate Return Line	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
PIT-100	Feed Header	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-110	VSEP#1 Feed Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-111	VSEP#1 Permeate Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-112	VSEP#1 Concentrate Line	1/4"	IFM Efector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
AE/AT-101	Permeate Return Line	3/4"	GF Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
TSH-101	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-101	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
PSL-100	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ

CIP Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
AE-190	CIP/Feed Line	3/4"	GF Signet	pH Electrode	Polypro, Titanium, Viton	~	3-2726-00
AIT-190	CIP/Feed Line	~	GF Signet	pH Transmitter	~	0.0 to 14.0	3-9900-1
AIT-190	CIP/Feed Line	~	GF Signet	pH Display	~	~	3-2750-1
TIT-190	VSEP CIP Feed Line	1/2"	IFM Efector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2351
TE-190	VSEP CIP Feed Line	1/2"	IFM Efector	Thermowell	316 SS	M18x1.5 to 1/2"	UT 0028
LIT-190	VSEP CIP Tank, T-190	1/4"	IFM Efector	Level Pressure Transmitter	316 SS, CoNiCr	-5-100 inH20	PN 2228
TSH-190	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-190	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429
PSL-190	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ

Stage-2 Spiral Skid

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TE/TIT-200	Spiral Feed Line	1/2"	Effector	Temperature Transmitter	316 SS Thermowell	-40º-125ºC	TN 2531
TE/TIT-300	Spiral Feed Line	1/2"	Effector	Metric Adapter	316 SS	M18x1.5 to 1/2"	E 40107
AE/AT-200	Spiral Feed Line	3/4"	Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
PDT-200	Bag Filter Inlet	1/4"	Effector	DP Pressure Transmitter	316 SS, CoNiCr	0-150 psi	PN 2224
PDT-201	Bag Filter Outlet	1/4"	Effector	DP Pressure Transmitter	316 SS, CoNiCr	0-150 psi	PN 2224
PIT-200	Feed Header	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-201	Permeate Line	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
PIT-202	Concentrate Line	1/4"	Effector	Pressure Transmitter	316 SS, CoNiCr	0-1450 psi	PN 2222
FIT-200	Concentrate Return Line	1"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	0.1-30 GPM	SM 0504
FIT-201	Permeate Return Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
FI-200	1st Stage Permeate Line	2"	IFM Efector	Mag Flow Meter	316L, PEEK, FKM	1.3-158.5 GPM	SM 2004
AE/AT-201	Permeate Return Line	3/4"	Signet	Conductivity Meter	Polypro, Titanium, Viton	10-10000 uS	3-2850-52-41
PI-200	Stage-1 Permeate outlet	1/4"	Wika	Pressure Indicator	316SS	0-600psi	9768530-834
FI-200	Stage-1 Permeate outlet	1.5"	GPI	Flow Indicator	316 SS, Tungsten Carbide, PVDF	20-200GPM	G2S15N09GMB
PSL-200	Air Regulator	3/8"	SMC	Low Pressure Switch	None	4 barg	IS10E-30N03-6PRZ
TSH-201	Booster Pump	3/4"	Grundfos	Dry Run Temperature Sensor	316 SS, Viton	0-135°C	96556427
TSH-201	Instrument Display	~	Grundfos	Dry Run Temperature Switch	None	130°C	96556429

Process Tank Instruments (provided by others)

Tag #	Location	Size	Brand Name	Device Type	Wetted Materials	Span Limits	Model #
TSH-110	Transfer Pump P-110	1/4"	Unknown	Low Pressure Switch	Unknown	Unknown	Unknown
LIT-110	T-110, VSEP Batch Feed Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-120	T-120, VSEP Reject Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-200	T-200, VSEP Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-210	T-210, VSEP Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228
LIT-300	T-300 Spiral RO Permeate Tank	1/4"	Unknown	Level Pressure Transmitter	317 SS, CoNiCr	-5-300 inH21	PN 2228
LIT-130	T-130, Hot Water Tank	1/4"	Unknown	Level Pressure Transmitter	316 SS, CoNiCr	-5-300 inH20	PN 2228

IFM Efector Flow Sensor Code Number Matrix

2" Flow	**SM2004**
1" Flow	**SM0504**

Code	Sensor Range
PN 2228	0-30 gpm (0-6.8 m3/hr)
PN 2226	0-160 gpm (0-36 m3/hr)
Code	**Connection**
-	Sensor with 24VDC power with 4-20mA output signal
Code	**Cable**
E18112	Washdown 4 pin M12 micro DC assemblies 5m

IFM Efector Pressure Sensor Code Number Matrix

Level	**PN 2228, E 18112**
Pressure	**PN 2222, E 18112**
DP	**PN 2226, E 18112**

Code	1/4" NPT Sensor Range
PN 2228	0-100 in H20
PN 2227	3-14 psi
PN 2226	7-36 psi
PN 2224	25-145 psi
PN 2223	76-362 psi
PN 2222	364-1450 psi
PN 2221	905-3625 psi
PN 2220	1450-5800 psi
Code	**G1/4 BSPP Sensor Range**
PN 2028	0-100 in H20
PN 2027	3-14 psi
PN 2026	7-36 psi
PN 2024	25-145 psi
PN 2023	76-362 psi
PN 2022	364-1450 psi
PN 2021	905-3625 psi
PN 2020	1450-5800 psi
Code	**Connection**
-	Sensor with 24VDC power with 4-20mA output signal
Code	**Cable**
E18112	Washdown 4 pin M12 micro DC assemblies 5m
E18113	Washdown 4 pin M12 micro DC assemblies 10m
E18111	Washdown 4 pin M12 micro DC assemblies 25m

IFM Efector Temperature Sensor Code Number Matrix

Temperature	**TN 2530, E 40107, E 18112**

Code	Sensors
TN 2530	24VDC power with 4-20 mA, -40 to 125 degC
TN 7530	Dual PNP, -40 to 125 degC

Code	Thermowell
UT 0028	M18x1.5 to 1/2" NPT male

Code	Cable
E18112	Washdown 4 pin M12 micro DC assemblies 5m
E18113	Washdown 4 pin M12 micro DC assemblies 10m
E18111	Washdown 4 pin M12 micro DC assemblies 25m

GF Signet pH Meter Code Number Matrix	
Electrode	**3-2774-1**
Transmitter	**3-2750-2**
Preamp	**3-2750-3**
Bracket	**3-2750-4**
Code	pH Electrode
3-2726	Flat pH surface electrode
Code	Temperature Elements
-	3k Ohm RTD
00	PT1000 RTD
Code	Transmitter
3-9900	Sensor with preamplified Digital S3L or 4-20mA output signal
Code	Electronics
1	In-line (yellow body)
Code	Preamp
3-2750-1	In-line w/ Junction Box
Code	Bracket
3-9900.396	Angled

GF Signet Conductivity Meter Code Number Matrix	
Meter	**3-2850-52-41**
Meter	**3-2850-52-42**
Code	Integral Mount System
3-2850	Conductivity Sensor Electronics
Code	Electronics Versions and Output Signal
51	Digital S3L output signal with EasyCal
52	4-20mA output signal with EasyCal
Code	Electrode
39	2839 Electrode, 0.01 cell
40	2840 Electrode, 0.1 cell
41	2841 Electrode, 1.0 cell
42	2842 Electrode, 10.0 cell
Code	Process Connection
D	ISO 7/1R 3/4
-	3/4" NPT

Signet 2850 Conductivity/Resistivity Sensor Electronics and Integral Systems

Universal Mount

Threaded J-Box

2850 Integral Conductivity System for in-line installations

Features

- Integral mount systems for quick and easy installation
- Compact design for maximum installation flexibility
- Digital (S^3L) interface or two-wire 4 to 20 mA output
- EasyCal with automatic test solution recognition
- Dual channel unit available for low cost installation with Signet 8900 Multi-Parameter Controller
- For use with ALL Signet conductivity electrodes

Description

The Signet 2850 Conductivity/Resistivity Sensor Electronics are available in various configurations for maximum installation flexibility. The universal mount version is for pipe, wall, or tank mounting and enables single or dual (digital versions only) inputs using any standard Signet conductivity / resistivity sensor. The threaded j-box version can be used with these same Signet sensors for submersible sensor mounting. It is also available as a combined integral system configuration for in-line mounting and includes a conductivity electrode in a choice of 0.01, 0.1, 1.0, or 10.0 cm^{-1} cell constants. The 2850 is ideal for applications with a conductivity range of 0.055 to 200,000 μS or a resistivity range of 18.2 MΩ to 10 kΩ.

All 2850 units are available with a choice of two outputs: digital (S^3L) or 4 to 20 mA. The digital (S^3L) output version allows for up to six sensor inputs directly into the Signet 8900 Multi- Parameter Controller. The two-wire 4 to 20 mA output is available with eight 4 to 20 mA output ranges for each electrode cell constant. Additionally, each range can be inverted and are field selectable by the user.

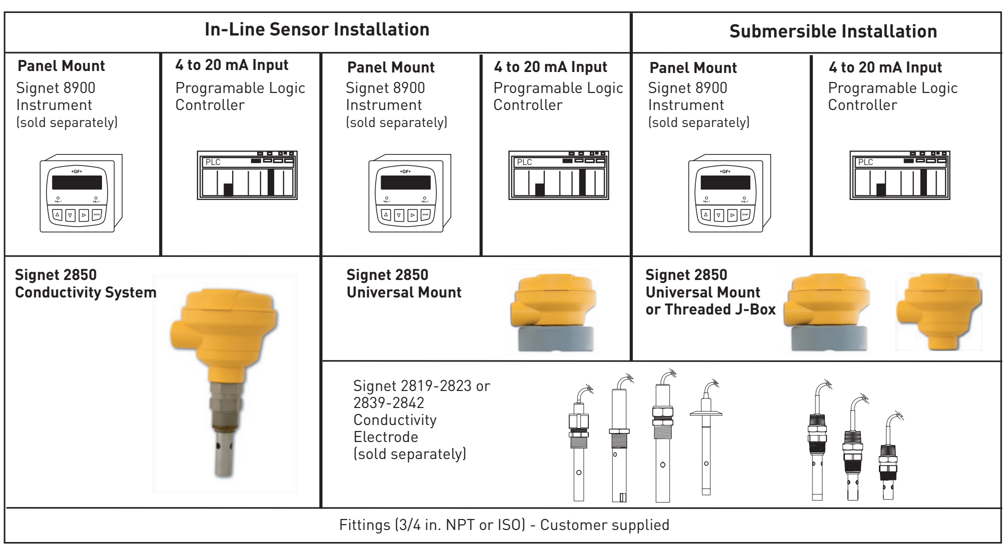
All 2850 units are built with NEMA 4X/IP 65 enclosures which allow wiring connections with long cable runs of up to 1,000 feet (305 m). EasyCal is a standard feature that automatically recognizes conductivity test solution values for simple field calibration. A calibration tool is available for validation of the sensor electronics according to USP requirements.

Applications

- Water Treatment & Water Quality Monitoring
- Reverse Osmosis
- Deionization
- Demineralizer, Regeneration & Rinse
- Scrubber, Cooling tower and Boiler Protection
- Aquatic Animal Life Support Systems

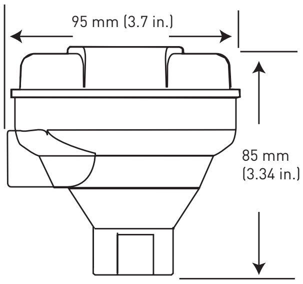
CE

System Overview

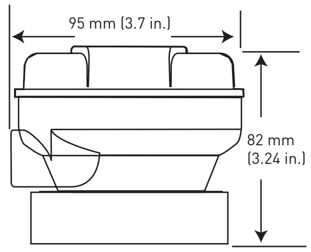


Dimensions

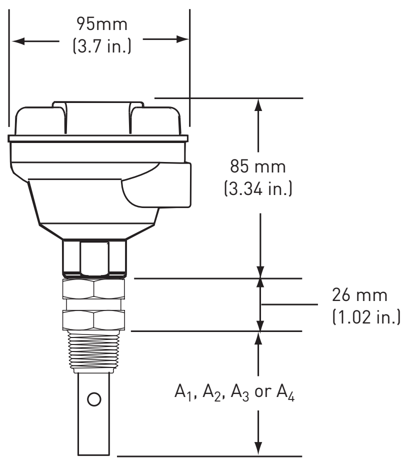
2850-5X threaded J-Box



2850-6X Universal Mount Systems



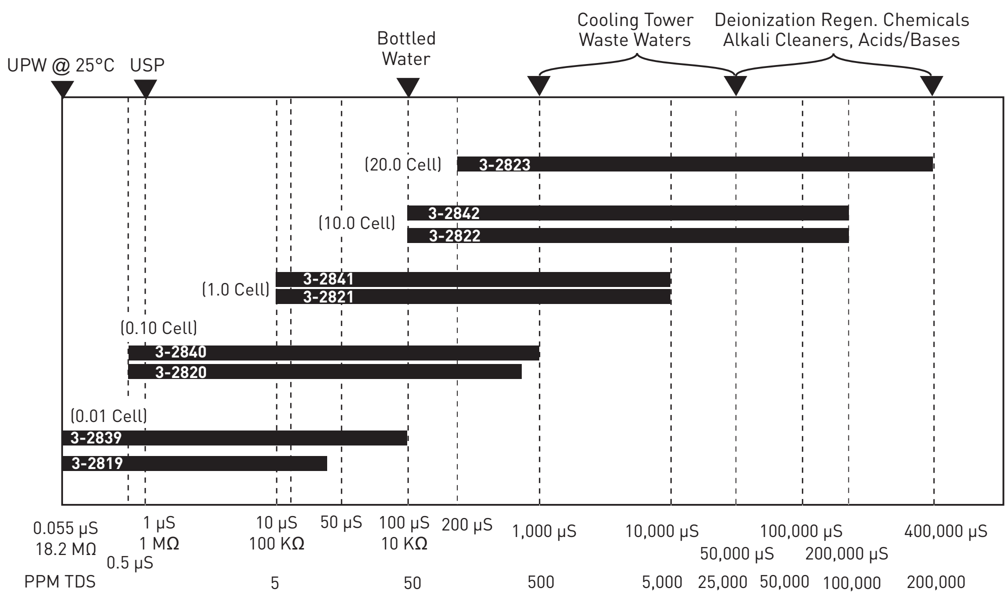
2850-5X-XX Integral Mount Systems



A_1 (3-2839) = 73mm (2.88 in.)
A_2 (3-2840) = 35mm (1.38 in.)
A_3 (3-2841) = 41.3mm (1.63 in.)
A_4 (3-2842) = 41.3mm (1.63 in.)

Operating Range Chart

The 2850 is capable of measuring conductivity and resistivity values over a wide range. Below is a chart of Signet Conductivity/Resistivity electrodes (listed in each range box) that are recommended for the specified measurement range.



Specifications:

General
Compatible Electrodes: All Signet models with PT-1000 RTD

Materials:
- Threaded j-box for Integral mount: PBT
- Universal/Remote mount: PBT, CPVC

Temperature Compensation:
PT-1000 RTD

Easy-Cal: Automatic recognition of the following conductivity values:
- 146.93 µS, 1408.8 µS, 12856 µS (@25°C) (Test solutions Per ASTM D1125-95)
- 10 µS, 100 µS, 200 µS, 500 µS, 1000 µS, 5000 µS, 10,000 µS, 50,000 µS, 100,000 µS (@25°C) (Standard test solutions)

Electrical
Power:
- 12 to 24 VDC for 4 to 20 mA output (typically called "Loop Powered")
- 5 VDC +/-5% regulated (provided by the Signet 8900), 3.0 mA max for Digital (S^3L) output (Reverse polarity and short circuit protected)

Digital (S^3L) Output: Serial ASCII, TTL level 9600 bps
- Accuracy:
  Conductivity: ±2% of reading
  Temperature: ±0.5°C
- Resolution:
  Conductivity: 0.1% of reading
  Temperature: < 0.2°C
- Update Rate:
  Single channel models: < 600 ms
  Dual channel models: < 1200 ms

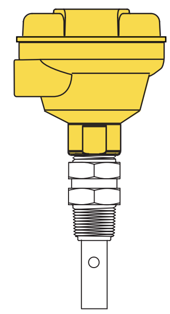
Electrical (continued):
Available data via Digital (S^3L) Output:
- Raw conductivity
- Calibrated conductivity
- Calibrated temperature-compensated conductivity
- Temperature

Error Indication: Open input and out of range diagnostics for temperature or internal electronic error.

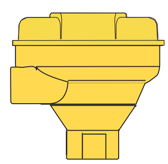
Current Output:
- Field-selectable ranges
- Factory set Span:
  0.01 cell (2819, 2839):
  4 to 20 mA = 0 to 100 µS
  0.10 cell (2820, 2840):
  4 to 20 mA = 0 to 1000 µS
  1.0 cell (2821, 2841):
  4 to 20 mA = 0 to 10,000 µS
  10.0 cell (2822, 2842):
  4 to 20 mA = 0 to 200,000 µS
  20.0 cell (2823):
  4 to 20 mA = 0 to 400,000 µS
- Max. Loop Resistance:
  50 Ω @ 12 VDC
  325 Ω @ 18 VDC
  600 Ω @ 24 VDC
- Accuracy: ±2% of output span
- Resolution: 7 µA
- Update Rate: <600 ms
- Error Indication: 22 mA
- Pure Water Compensation:
  When using 0.01-cm cell and raw conductivity value < 0.5 µS, the 2850 auto-switches to compensate for non-linear temperature effects found in this low conductivity (high resistivity) range

Shipping weight:
- Threaded j-box:
  0.75 kg (1.75 lb.)
- Universal mount:
  0.75 kg (1.75 lb.)

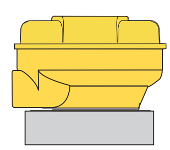
Standards and Approvals
- NEMA 4X/IP65
- CE
- Immunity: EN61326-1
- Emissions: EN55011 Class B
- Manufactured under ISO 9001:2000 for Quality and ISO 14001:2004 for Environmental Management



Integral System includes the 2850 sensor electronics and a choice of Conductivity/Resistivity electrode.



-5X threaded J-Box



-6X Universal/Remote Mount

Field Selectable Ranges for 4 to20 mA Operation

The chart below indicates the field selectable ranges in which the 2850 sensor electronics can be set via internal switches. All ranges can be inverted if required. Signet Models listed below are compatible Conductivity/Resistivity electrodes.

0.01 Cell	0.10 Cell	1.0 cell	10.0 Cell	20.0 Cell
Signet Model 2819 or 2839	Signet Model 2820 or 2840	Signet Model 2821 or 2841	Signet Model 2822 or 2842	Signet Model 2843
10 to 20 MΩ	0 to 2 µS	0 to 20 µS	0 to 200 µS	0 to 400 µS
2 to 10 MΩ	0 to 5 µS	0 to 50 µS	0 to 500 µS	0 to 1,000 µS
0 to 2 MΩ	0 to 10 µS	0 to 100 µS	0 to 1,000 µS	0 to 2,000 µS
0 to 1 MΩ	0 to 50 µS	0 to 500 µS	0 to 5,000 µS	0 to 10,000 µS
0 to 5 MΩ	0 to 100 µS	0 to 1000 µS	0 to 10,000 µS	0 to 20,000 µS
0 to 10 MΩ	0 to 200 µS	0 to 2000 µS	0 to 50,000 µS	0 to 100,000 µS
N/A	0 to 500 µS	0 to 5,000 µS	0 to 100,000 µS	0 to 200,000 µS
N/A	0 to 1,000 µS	0 to 10,000 µS	0 to 200,000 µS	0 to 400,000 µS
The 4 to 20 output ranges shown in this chart can be inverted using the internal switch **Resistivity Ranges are in BOLD**				

Ordering Information

2850 Integral Systems

Use this ordering matrix when an integral 2850 system is desired (using 2839-2842 series electrodes). Integral systems are shipped with a sensor and 2850 combined. Other 2850 systems are available with Signet 2819 to 2823 electrodes upon request. See individual electrode product pages for more information.

Integral Mount System (includes Sensor Electronics and electrodes)				
3-2850	Conductivity and Resistivity Sensor Electronics			
	Output Type			
	-51	Digital (S^3L) output with EasyCal		
	-52	4 to 20mA output with EasyCal		
		Sensor Option		
		-39	2839 Electrode, 0.01 cell	
		-40	2840 Electrode, 0.1 cell	
		-41	2841 Electrode, 1.0 cell	
		-42	2842 Electrode, 10.0 cell	
			Process threaded connection types	
			D	ISO threads
			-	NPT threads
3-2850	**-52**	**-39**		**Example Part Number**

2850 Sensor Electronics

Use this ordering matrix when remote sensor mounting is desired. The 2850-5X and 2850-6X are compatible with ALL Signet conductivity electrodes. See individual electrode product pages for more information.

Sensor Part Number			
3-2850	Conductivity Sensor Electronics with 4 to 20 mA or digital output		
	Mounting configurations		
	-5	3/4 inch threaded j-box for standpipe mounting, single input only	
	-6	Universal Mount Junction Box for remote mount, single or dual input	
		Output choices	
		1	one input/one Digital (S^3L) output
		2	one input/one 4 to 20 mA output
		3	two inputs/two Digital (S^3L) outputs (available for -6X versions only)
3-2850	**-5**	**2**	**Example Part Number**

Model 2850
Ordering Notes:

1) All 2850 units can be used with any Signet Conductivity/Resistivity electrode
2) Integral systems are only offered with Signet models 2839-2842 electrodes. However, they may be integrally mounted with the 2819-2842 series using a second threaded connection (sold separately) part numbers 3-2820.390 or 3-2820.391.
3) Dual channel units are only available in the universal/remote mount configuration and with digital (S^3L) output for use with the 8900 instrument.

Application Tips:

- Maximum distance between sensor and 2850 electronics is 4.6m (15 ft.).
- Longer cable runs may result in small temperature compensation offsets, but can be adjusted through calibration in the 8900.

Please refer to Wiring, Installation and Accessories for more information.

Mfr. Part No.	Code	Mfr. Part No.	Code	Mfr. Part No.	Code
3-2850-51	**159 001 398**	3-2850-51-41D	**159 001 345**	3-2850-52-39D	**159 001 351**
3-2850-51-39	**159 001 339**	3-2850-51-42D	**159 001 346**	3-2850-52-40D	**159 001 352**
3-2850-51-40	**159 001 340**	3-2850-52	**159 001 399**	3-2850-52-41D	**159 001 353**
3-2850-51-41	**159 001 341**	3-2850-52-39	**159 001 347**	3-2850-52-42D	**159 001 354**
3-2850-51-42	**159 001 342**	3-2850-52-40	**159 001 348**	3-2850-61	**159 001 400**
3-2850-51-39D	**159 001 343**	3-2850-52-41	**159 001 349**	3-2850-62	**159 001 401**
3-2850-51-40D	**159 001 344**	3-2850-52-42	**159 001 350**	3-2850-63	**159 001 402**

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-2850.101-1	**159 001 392**	Plug-in NIST traceable recertification tool, 1.0 µS simulated
3-2850.101-2	**159 001 393**	Plug-in NIST traceable recertification tool, 2.5 µS simulated
3-2850.101-3	**159 001 394**	Plug-in NIST traceable recertification tool, 10.0 µS simulated
3-2850.101-4	**159 001 395**	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated
3-2850.101-5	**159 001 396**	Plug-in NIST traceable recertification tool, 10.0MΩ simulated
3-2839-3	**159 001 355**	Electrode - 0.01 µS/cm, 6 in. cable, NPT
3-2839-3D	**159 001 359**	Electrode - 0.01 µS/cm, 6 in. cable, ISO
3-2840-3	**159 001 356**	Electrode - 0.1 µS/cm, 6 in. cable, NPT
3-2840-3D	**159 001 360**	Electrode - 0.1 µS/cm, 6 in. cable, ISO
3-2841-3	**159 001 357**	Electrode - 1.0 µS/cm, 6 in. cable, NPT
3-2841-3D	**159 001 361**	Electrode - 1.0 µS/cm, 6 in. cable, ISO
3-2842-3	**159 001 358**	Electrode - 10.0 µS/cm, 6 in. cable, NPT
3-2842-3D	**159 001 362**	Electrode - 10.0 µS/cm, 6 in. cable, ISO
5523-0322	**159 000 761**	Cable, 3-cond. plus shield, 22AWG

One transmitter for multiple measurements

Signet 9900 Transmitter

+GF+

GEORG FISCHER
PIPING SYSTEMS

Benefits

The 9900 Transmitter offers "at-a-glance" visibility, easy set-up and the flexibility to combine it with different parameters.

As a new member of the Signet SmartPro™ family of instruments, the Signet 9900 Transmitter provides a single channel interface for many different parameters including Flow, pH/ORP, Conductivity/Resistivity, Salinity, Temperature, Pressure, Level and other sensors that output a 4 to 20 mA signal.

9900 Transmitter – Panel and Field Mount

At-a-glance visibility
The highly illuminated display and extra large (3.90" x 3.90") auto-sensing backlit display can be viewed at 4-5 times the distance over traditional transmitters. Large characters are easily visible even in dark conditions. The display shows separate lines for units, main and secondary measurements as well as a "dial-type" digital bar graph.

Quick and easy installation
The intuitive menu system is consistent with ProcessPro® and ProPoint® transmitters.

With our PC COMM configuration tool you can easily set-up the parameters on your laptop.

Flexibility
One instrument for multiple measurements. Designed for complete flexibility, plug-in modules allow the unit to easily adapt to meet changing customer needs. Optional modules include Relay, Direct Conductivity/Resistivity, H COMM and a PC COMM configuration tool.

Relay Module

Direct Conductivity/Resistivity Module

H COMM Module

0251 Configuration Tool

Features

Default values are available for quick and easy programming and can be customised if desired.

For at-a-glance visibility, the 9900 Transmitter features a large auto-sensing backlit display, "dial-type" bar graph and relay and warning LEDs. The intuitive menu system is consistent with ProcessPro® and ProPoint® transmitters, assuring you of a quicker and easier installation. The optional Relay, Direct Conductivity/Resistivity, H COMM and PC COMM plug-in modules offers ease of use. The unit can be used with default values for quick and easy programming or can be customised with labelling, adjustable minimum and maximum dial settings, and unit and decimal measurement choices. The versatile device also allows third-party 4 to 20 mA signals to be used as an input (optional 8058 module required).

Features

One unit can replace ProPoint® and single-channel ProcessPro® instruments, dramatically reducing part numbers.

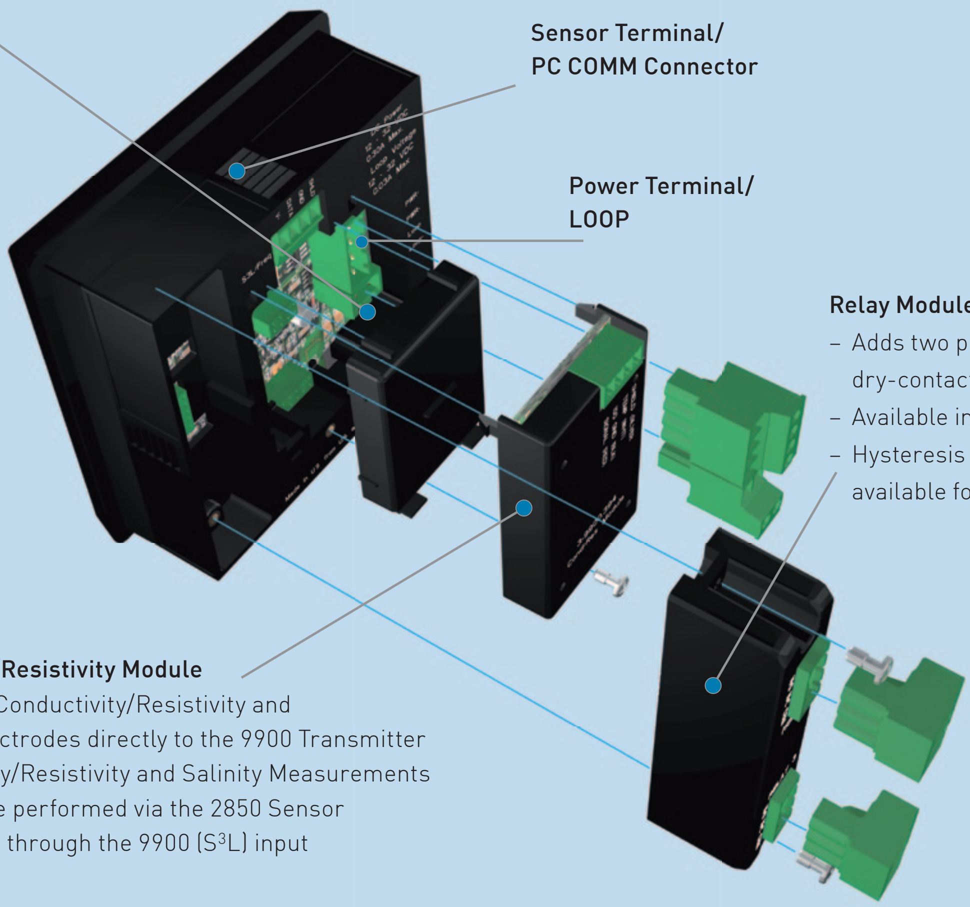
The 9900 Transmitter can be integrated in a panel unit or mounted in the field. Both configurations can run on 12 to 32 VDC power (24 VDC nominal) and can control many types of sensors on loop power.

H COMM Module
- Allows communication between the 9900 Transmitter and any HART® enabled device
- Allows access to Primary and Secondary measurements remotely
- Allows user to remotely adjust the 4 and 20 mA settings

PC COMM Module
- Enables configuration and programming from a PC
- Settings from one 9900 Transmitter can be saved to a PC and applied to future installations
- Compatible with Windows 7, Vista and XP

Sensor Terminal/ PC COMM Connector

Power Terminal/ LOOP



Relay Module
- Adds two programmable dry-contact relays
- Available in panel mount only
- Hysteresis and time delay available for each relay

Conductivity/Resistivity Module
- Interfaces Conductivity/Resistivity and Salinity Electrodes directly to the 9900 Transmitter
- Conductivity/Resistivity and Salinity Measurements may also be performed via the 2850 Sensor Electronics through the 9900 (S^3L) input

System Overview

The angle adjustment adapter kit quickly and easily converts your 9900 Field Mount Transmitter to any angle.

Additional accessories are available to help you with field installations. We provide solutions for field mounting by offering a separate mounting kit. The 3-8050 Universal Mount Kit, the 3-8051 or 8052 Integral Mount Kits, and the Angle Adjustment Adapter Kit enable the transmitter to be installed virtually anywhere. The adapter angles the transmitter by 25° degrees, allowing moisture to run off the display. The accessory enhances the versatility of the 9900 Field Mount Transmitter.

9900 Field Mount Transmitter
Field mounting requires a separate mounting kit. The 3-8050 Universal Mount Kit, the 3-8051 or 8052 Integral Mount Kits, and the Angle Adjustment Adapter Kit enable the transmitter to be installed virtually anywhere.

Angle Adjustment Adapter Kit
The angle adjustment adapter kit quickly and easily converts your 9900 Field Mount Transmitter to a 25° angle. This accessory enhances the versatility of the 9900 Field Mount Transmitter.

Mounting Kits
For Field Mount installations with a Conductivity/ Resistivity Module, the Angle Adjustment Adapter is required along with a 3-8050, 8051 or 8052 adapter kit to allow for sufficient clearance for the wiring.

Applications

The 9900 Transmitter in a tank filling application.

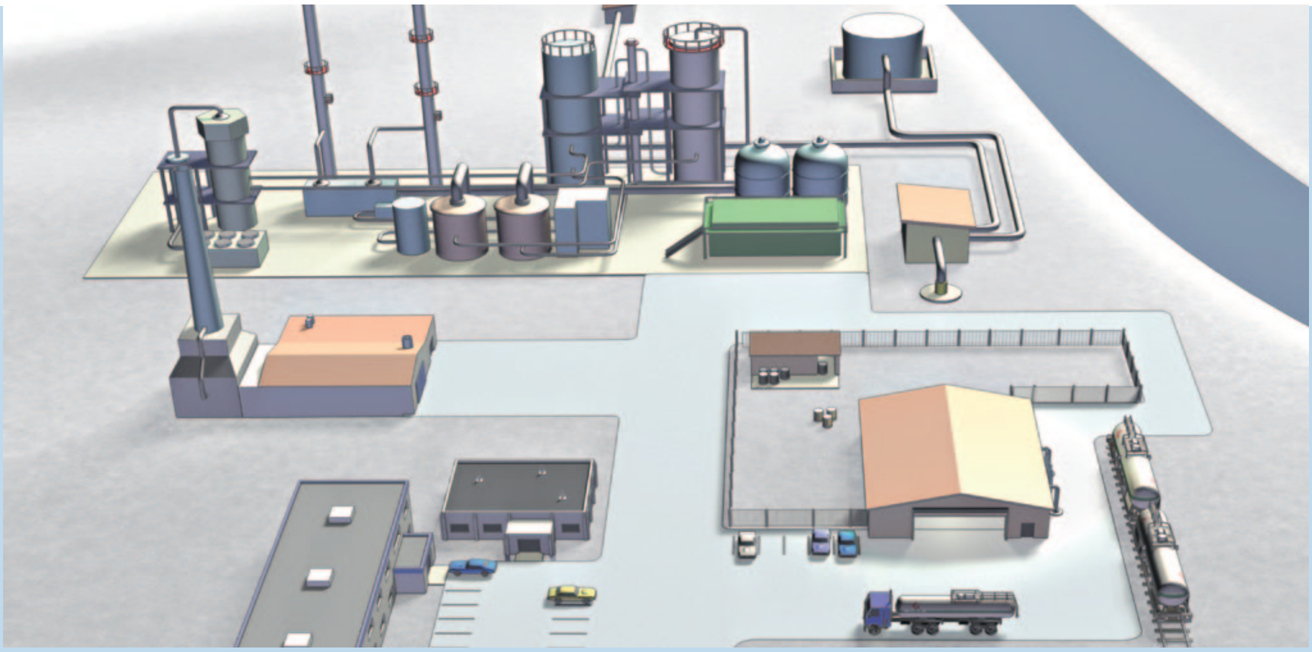
The 9900 versatile parameter and modularity capabilities make the unit well suited for a variety of applications including wastewater treatment, reverse osmosis, deionisation, chemical manufacturing, metal and plastic finishing, fume scrubbers, cooling towers and media filtration.

+GF+

Applications

No matter which processes and applications - GF Piping Systems supports its customers in every phase of the project.

From start to finish, we stand beside our customers as a competent, reliable and experienced partner, actively contributing the know-how of an industrial company that has been successful in the market for over 200 years. With our application knowledge and product expertise we support our customers during the planning process, the sustainable realisation of the projects and the provision of services.



Industrial & Municipal Water treatment
Water treatment, whether it is for municipal or industrial applications, typically serves to improve the quality of the water to ensure public safety or to reduce negative impacts on process equipment and/or the environment. The 9900 Transmitter, part of the new SmartPro family, is ideal for use in measurement and control of various water treatment applications. Industrial Water Treatment applications include media filtration, deionisation, desalination, cooling tower control, reverse osmosis, and fume scrubbers, while chlorine dioxide and ozone control are common in Municipal Water Treatment applications. Monitoring the quantity and quality of various parameters such as acidity/alkalinity of chemicals, salts, and chlorine concentrations are all important in delivering processed water to the quality standards demanded by each unique application.

Chemical process industry
The 9900 and applicable sensors can be used for measurement and control in the transport and dilution of various chemicals. Managing chemical tank levels and dosing of chemicals can all be monitored and controlled using the new 9900 Transmitter.

GF Piping Systems – worldwide at home

Our sales companies and representatives
ensure local customer support in over 100 countries.

www.gfsignet.com

The technical data is not binding. They neither constitute expressly warranted characteristics nor guaranteed properties nor a guaranteed durability. They are subject to modification. Our General Terms of Sale apply.

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GEORG FISCHER
PIPING SYSTEMS

Signet 2750 DryLoc® pH/ORP Sensor Electronics

In-line 2750

Submersible 2750

2750-7

DryLoc® Electrodes sold separately.

The Signet 2750 pH/ORP Sensor Electronics featuring the DryLoc® connector, provides a variety of functions to suit various requirements.

The 2750 has a preamplified signal and features two different outputs: a two-wire 4 to 20 mA loop output with EasyCal function or a digital (S^3L) output which allows for longer cable lengths and is compatible with the Signet 8900 or 9900 instruments.

The 2750 self-configures for pH or ORP operation via automatic recognition of the electrode type. The optional EasyCal feature allows simple push-button calibration and includes an LED indicator for visual feedback.

The DryLoc® electrode connector quickly forms a robust assembly for submersible and in-line installations. NEMA 4X junction enclosures are integral parts of the 2750 in-line version and are also available as accessories for the submersible 2750.

The 2750 submersible preamplifier can also be used as an In-line preamplifier when used with the 3/4" or 1" threaded sensors including the 2724, 2774 and 2764 series electrodes. The 2750 In-line preamplifier can be used with Signet fittings up to DN100 (4 in.) and wet-tap assemblies.

Features

- **In-line integral mount and submersible installation versions**
- **Automatic temperature compensation**
- **Auto configuration for pH or ORP operation**
- **Optional EasyCal calibration aid with automatic buffer recognition**
- **Junction boxes for convenient wiring**
- **Patented DryLoc® connector provides a quick and secure connection to the sensor***

Applications

- **Water and Wastewater Treatment**
- **Neutralization Systems**
- **Scrubber Control**
- **Effluent Monitoring**
- **Surface Finishing**
- **Flocculent Coagulation**
- **Heavy Metal Removal and Recovery**
- **Toxics Destruction**
- **Sanitization Systems**
- **Pool & Spa Control**
- **Aquatic Animal Life Support Systems**

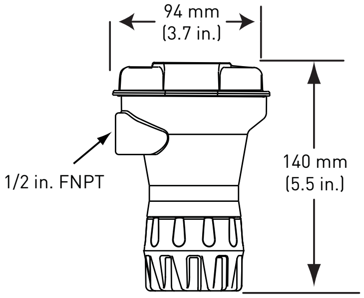
*U.S. Patent No.: 6,666,701

Specifications

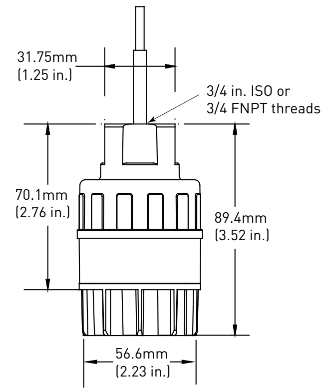
General			
Compatible Electrodes			
Signet DryLoc® pH and ORP Electrodes, Models 2724-2726, 2756-2757 Wet-Tap, 2764-2767, 2774-2777			
Operating Range	pH	0 to 14 pH	
	ORP	±2,000 mV	
Response Time	pH	< 6 sec. for 95% of change	
	ORP	application dependent	
Materials	In-line	Valox® (PBT)	
	Submersible	CPVC	
Electrical			
Cable	4.6 m / 15 ft	3-conductor shielded (3-2750-3 or -4 submersible sensor electronics only)	
	22 AWG	For 9900 and 4 to 20 mA max. cable length is 1000 ft. (For 8900 please refer to the Cable Calculation Table on pg. 333 for max. cable length)	
Power	12 to 24 VDC	±10%, regulated for 4 to 20 mA output	
	5 to 6.5 VDC	±5% regulated recommended, 3 mA max., for digital (S^3L) output	
Current Output	pH	Fixed 4 to 20 mA, isolated, = 0 to 14 pH (custom scaling available with 0250 tool)	
	ORP	Fixed 4 to 20 mA, isolated, = -1000 to 2000 mV (custom scaling available from ± 000 mV with 0250 tool)	
Max Loop Resistance	100 Ω max. @ 12 V	325 Ω max. @ 18 V	600 Ω max. @ 24 V
Accuracy	±32 μA		
Resolution	±5 μA		
Update Rate	0.5 seconds		
Error Indication	3.6 mA		
Digital (S^3L) Output	Serial ASCII, TTL level 9600 bps		
Accuracy	pH	± 0.03 pH @ 25 °C	± 0.03 pH @ 77 °F
	ORP	± 2 mV @ 25 ° C	± 2 mV @ 77 °F
Resolution	pH	≤ 0.01 pH	
	ORP	1 mV	
Temperature	≤ 0.2 °C	0.36 °F	
Update Rate	0.5 seconds		
Available Data	Raw mV, pH or ORP, temperature (pH)		
Error Indication	Open input diagnostic		
Input Impedance, Z	$>10^{11}\Omega$		
Environmental			
Enclosure	3-2750-1 & -2	NEMA 4X/IP65 with electrode connected	
	3-2750-3 & -4	NEMA 6P/IP68 with electrode and watertight conduit and/or extension pipe connected	
Max. Temperature/Pressure Rating			
Operating Temperature			
submersible	0 °C to 85 °C	32 °F to 185 °F	
in-line	0 °C to 110 °C	32 °F to 230 °F	
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F	
Relative Humidity	0 to 95%, non-condensing (without electrode connected)		
Shipping Weight			
	2750-1 & 2	0.75 kg	1.65 lb
	2750-3 & -4	0.64 kg	1.41 lb
Standards and Approvals			
	CE, FCC		
	RoHS compliant, China RoHS		
	Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety		

Dimensions

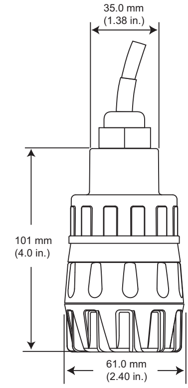
3-2750-1,-2



3-2750-3, -4



3-2750-7

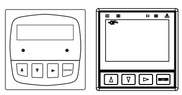


System Overview

In-Line Installation

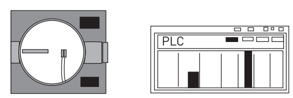
Panel Mount

Signet Instruments
8900 9900



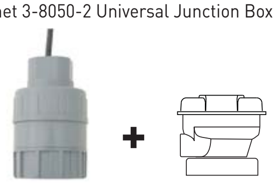
4 to 20 mA input

Customer Supplied Chart Recorder
or Programmable Logic Controller



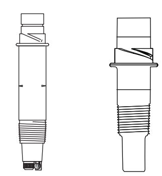
Signet 2750 Sensor Electronics

Signet 2750 Sensor Electronics
with Signet 3-8050-2 Universal Junction Box (EasyCal)



Signet 2750 Sensor Electronics

Signet Electrodes
2724-2726
2764-2767
2774-2777



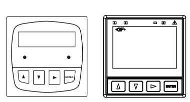
2724-2726 DryLoc® Electrodes: Use GF Fittings* or customer supplied 3/4 in. NPT fittings
2764-2767 and 2774-2777 DryLoc® Electrodes: Use customer supplied 3/4 in. or 1 in. NPT fittings

All sold separately

Submersible Installation

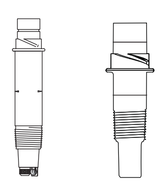
Panel Mount

Signet Instruments
8900 9900



Signet 2750 Sensor Electronics
with customer supplied pipe extension or conduit, 3/4 in. NPT or ISO 7/1-R 3/4 threads**

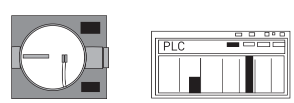
Signet Electrodes
2724-2726
2764-2767
2774-2777



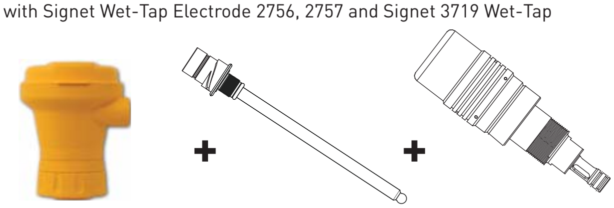
Wet-Tap Installation

4 to 20 mA Input

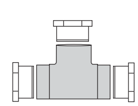
Customer Supplied Chart Recorder
or Programmable Logic Controller



Signet 2750 Sensor Electronics
with Signet Wet-Tap Electrode 2756, 2757 and Signet 3719 Wet-Tap



GF Tees and Fittings
see model 3719 for more info



All sold separately

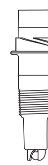
* See fittings section for more information.

2750 Product Selection Guide

1. Choose the Electrode

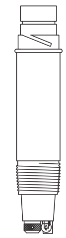
2724-2726

Can use Any 3-272x series Electrode



2764-2767 Differential

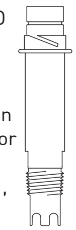
3-2764-1
3-2764-2
3-2766-1
3-2766-2



2774-2777

ORP electrodes must have 10K ID resistor use: 3-2775, 3-2777

pH Electrodes can be either the 1K or 3K use: 3-2774, 3-2774-1, 3-2776, 3-2776-1

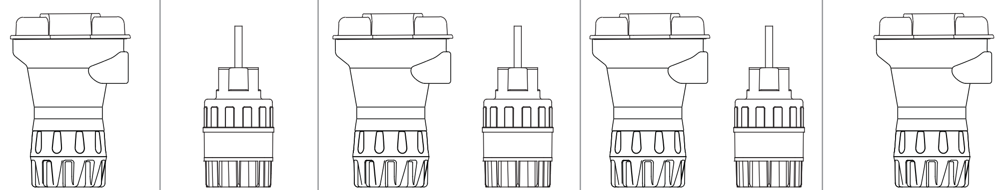


2756 and 2757 Wet-Tap

Can use any Wet-Tap 275x series electrode

2. Determine the mounting style:

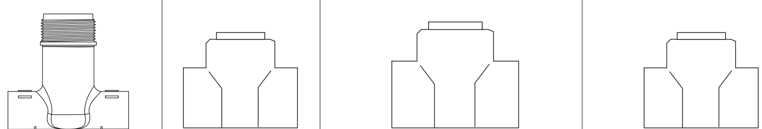
In-line



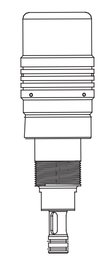
2724-2726		2764-2767		2774-2777		2756 and 2757
2750-1 or -2	2750-3 or -4	2750-1 or -2	2750-3 or -4	2750-1 or -2	2750-3 or -4	2750-1 or -2

And

-In-line fitting



Signet fitting | ¾" reducing tee | 1" threaded tee | ¾" reducing tee



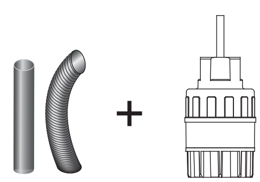
3719 Wet-Tap Assembly

(Submersible not applicable with Wet-Tap assembly)

Or

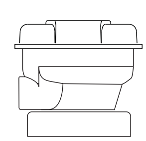
Submersible

2750-3 or -4
and cable conduit (customer supplied) connected to ¾" sensor electronics



3. Junction Boxes

3-8050-1: Use when extending the submersible cable over long distance.
3-8050-2: Use with the submersible 2750-3 or -4 and the in-line 2750-1 for best calibration results with the EasyCal function when using the blind 4 to 20 mA output.

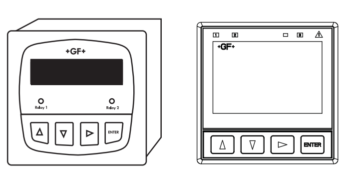


4. Choose the output instrument

Digital (S^3L)

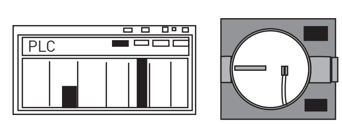
Or

4 to 20 mA



8900 or 9900 Instruments

OR



PLCs or Chart Recorders

Model 2750 Ordering Information

1) Model 2750 requires 12 to 24 VDC to function as a blind 4 to 20 mA output transmitter.

2) Order a 3-2750-2 or any other 2750 with a junction box 3-8050-2 if the EasyCal feature is desired.

3) Conduit and mounting brackets for submersion installation must always be used (customer supplied).

4) The 3-2759 System Tester must be ordered with the adapter cable 3-2759.391 for exclusive use with the 2750.

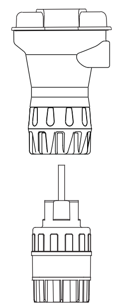
5) All sensor electronics, preamplifiers and connectors require a DryLoc® electrode for full system installation.

Application Tips

- The EasyCal feature automatically recognizes standard 4.0, 7.0, and 10.0 pH buffer or ORP quinhydrone solutions of 87 and 264 mV and simplifies calibration

- Frequency of calibration of electrodes is dependent upon the application.

Ordering Information



Mfr. Part No.	Code	Description
In-line Sensor Electronics (Yellow body)		
3-2750-1	**159 000 744**	Recommended for 8900 or 9900 instruments
3-2750-2	**159 000 745**	with EasyCal, recommended for 4 to 20 mA use
3-2750-7	**159 001 671**	pH electronics, Digital (S^3L), 4.6 m (15 ft) cable
Submersible Sensor Electronics (Grey body)		
3-2750-3	**159 000 746**	with 4.6 m (15 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2750-4	**159 000 842**	Submersible Sensor electronics with 4.6 m (15 ft) cable and ISO 7/1R 3/4 threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal

Sensor Electronics with preamplified signal and Digital (S^3L) output (for use with the Multi-Parameter Instruments) or 4 to 20 mA output - power supplied to unit dictates output type.

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
Calibration		
3-2700.395	**159 001 605**	Calibration kit: includes 3 polyproplyene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP system tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 adapter cable for use with 2750 -DryLoc® sensor electronics
3-0700.390	**198 864 403**	pH buffer kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10 buffer solution, 1 pint (473 ml) bottle
Mounting		
3-8050.390-1	**159 001 702**	Retaining nut replacement kit, Valox K4530
3-8050-1	**159 000 753**	Universal mount junction box
3-8050-2	**159 000 754**	Universal mount junction box w/EasyCal (for submersible applications, use with 3-2750-3/4 where 4 to 20 mA is required)
3-9000.392-1	**159 000 839**	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	**159 000 841**	Liquid tight connector kit, PG 13.5 (1 connector)
Other		
5523-0322	**159 000 761**	Sensor cable (per ft), 3-cond. plus shield, 22 AWG, black/red/white (for use with 2750)

3401 Aero Jet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057 • www.gfsignet.com • e-mail: signet.ps@georgfischer.com

Signet 2724-2726 pH/ORP Electrodes

Compatible with ALL Signet pH/ORP Instruments


Flat Glass


Protected Bulb

The Signet 2724-2726 pH and ORP Electrodes features a patented reference electrode design and uses the unique foul-proof patented DryLoc® connector. The large area PE reference junction and pathway is constructed to increase the total reference effectiveness and ensures long service life.

The DryLoc® connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2760 preamplifier or the 2750 sensor electronics. The robust Ryton® threaded sensor body and choice of flat pH, bulb pH, or flat ORP sensing elements provides broad range of chemical compatibility for a wide variety of applications. There are two optional pH sensing versions available, HF and LC. The HF version is for applications where traces of hydrofluoric acid (2% or less) will attack standard pH glass in levels of pH 6 and below. The LC version can be used for low conductivity fluids 20 - 100 µS/cm nominal and below 20 µS when mounted under controlled conditions.

The quick temperature response is available in either a PT1000 or 3 KΩ temperature sensor and allows compatibility with all Signet pH/ORP instruments. The 2724-2726 electrodes are general-purpose sensors ideal for a wide range of applications. The sensors incorporate ¾ inch NPT or ISO 7/1-R 3/4 threads for installing into standard pipe-tees. They can also be mounted directly into Signet standard fittings, DN15 to DN100 (½ to 4 inch)

Features

- **Patented reference design for exceptional performance ***
- **Mounts in Signet standard fittings from DN15 to DN100 (½ to 4 in.)**
- **¾" NPT or ISO 7/1-R 3/4 threaded sensors for use with reducing tees DN15 to DN100 (½ to 4 in.)**
- **Special design allows for installation at any angle, even inverted or horizontal**
- **Ryton® (PPS) body for broad range of chemical compatibility**
- **Patented DryLoc® connector with gold plated contacts**
- **Quick temperature response**
- **HF resistant glass available for trace HF of ≤2%**
- **Low conductivity sensor available for liquids down to 20 µS/cm**

Applications

- **Water & Wastewater Treatment**
- **Neutralization Systems**
- **Effluent Monitoring**
- **Sanitization Systems**
- **Pool & Spa Control**
- **Aquatic Animal Life Support Systems**
- **Process Control**
- **Cooling Towers**

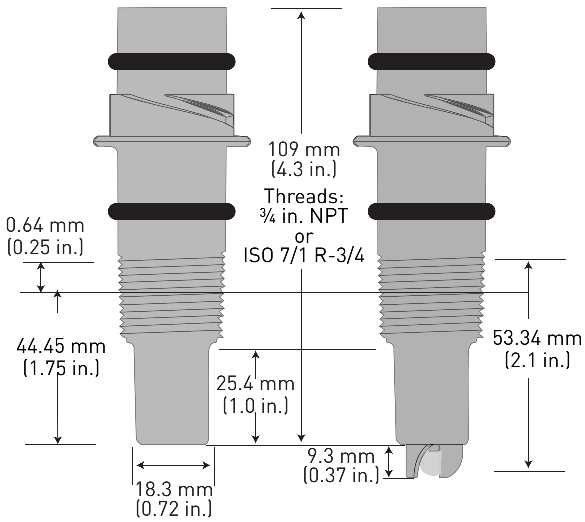
*U.S. Patent Nos.: 6,666,701, 7,799,193 B2, 7,867,371 B2 and 8,211,282 B2

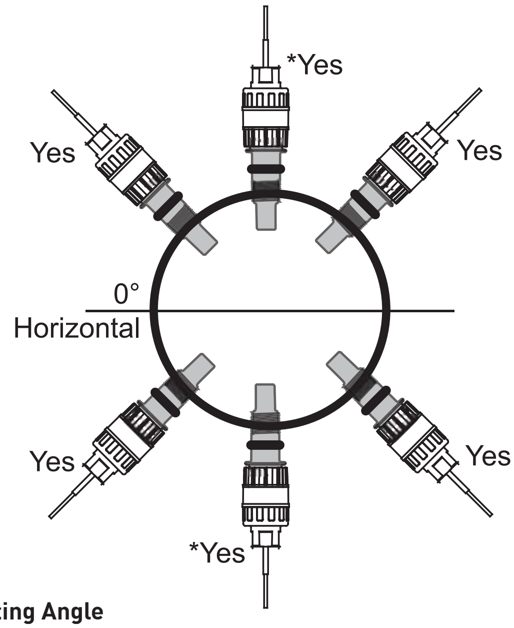
Specifications

General			
Performance	Efficiency	>97% @ 25 °C (77 ° F)	
Operating Range	pH	0 to 14 pH	
	ORP	±2000 mV	
	3-2726-LC	Low conductivity fluids; 20 - 100 μS/cm nominal < 20 μS; flow must be less than 150 ml/min in a properly grounded system	
	3-2726-HF	Hydrofluoric acid resistant glass, pH 6 or below; trace HF $\leq$2%	
Compatibility			
	2750 Electronic (for 8900, 9900, 4 to 20 mA), 2760 Preamplifier (8750)		
Temperature Sensor			
	PT1000 versions	compatible with Signet 2750 pH/ORP Sensor electronics for connection to a PLC or to the Signet 8900 or 9900 instruments	
	3 KΩ Balco versions	compatible with the Signet 2760 pH/ORP preamplifier for connection to the Signet 8750 pH/ORP Transmitter	
Process Connection			
	¾ in. NPT	ISO 7/1-R 3/4	Mounts into Signet fittings
Wetted Materials			
	pH	Ryton® (PPS), glass, UHMW PE, FPM	
	ORP	Ryton® (PPS), glass, UHMW PE, FPM, Platinum	
Max. Temperature/Pressure Rating			
Operating Temperature Range*		-10 °C to 85 °C	14 °F to 185 °F
Operating Pressure Range		6.8 bar @ -10 to 65 °C (100 psi @ 14 to 150 °F)	
		4 bar @ 65 to 85 °C (58 psi @ 150 to 185 °F)	
*Best performance for 2726-HF sensors is above 10 °C (50 °F)			
Recommended Storage Temperature			
		0 °C to 50 °C	32 °F to 122 °F
The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)			
The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)			
Mounting			
In-line Mounting	Use the sensor threads		
	Use a Signet standard fitting up to 4 in.		
	Sensor can be mounted at any angle		
Submersible Mounting	Use threads on models 2750 or 2760		
	Requires ¾ inch NPT or ISO 7/1-R 3/4 male threaded liquid tight extension conduit.		
Shipping Weight			
	0.25 kg	0.55 lb	
Standards and Approvals			
	Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety		

See Temperature and Pressure graphs for more information

Dimensions



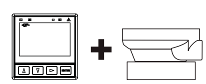
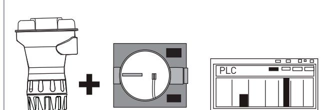


Mounting Angle

Models 2724-2726 may be mounted at any angle without affecting the performance.

*Avoid locations with air pockets and sediment.

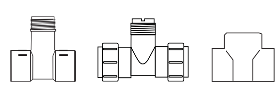
System Overview

Panel Mount	Field Mount - Pipe, Tank, Wall	4 to 20 mA Input
Signet Instruments 8750 with 2760 Preamplifier 8900 9900 with 2750 Electronics	Signet Instruments 9900 with 2750 Electronics and 3-8050 Universal Mount kit	3-2750 Sensor Electronics and customer supplied Chart Recorder or Programmable Logic Controller
		

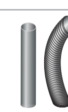
Signet 2724-2726
DryLoc® pH/ORP Electrodes

All sold separately

In-Line Installation -
Signet and threaded fittings only



Submersible Installation -
Customer supplied pipe extension or conduit with 3/4 in. NPT or ISO 7/1-R 3/4 threads*



*Refer to the Signet Submersion brochure located in the K-Factors Fittings and More Kit (3-0000-709) for installation suggestions and options.

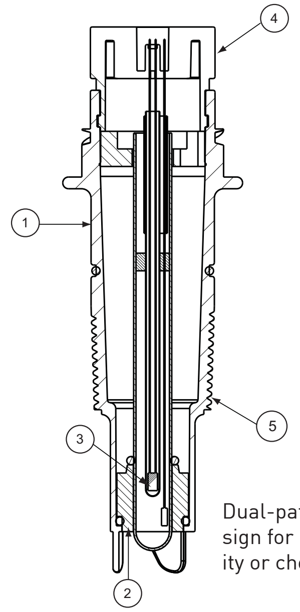
Electrode Key Features and Benefits:

1. Ryton® body for chemical compatibility with most harsh chemicals.
2. Porous UHMW PE (ultra high molecular weight polyethylene) junction resists fouling and build-up.
3. Internal temperature sensor located in the glass stem for a quick temperature response.
4. DryLoc® connector with corrosion resistant gold pins for quick and easy sensor removal.
    - Resists moisture and dirt intrusion.
5. Dual-patented reference design with a 406 mm
    - (16 inch) reference pathway enhances longer life. This enables the sensor to last significantly longer than other standard pH/ ORP electrodes in most applications.

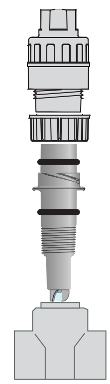
5a. With the new patented reference design, the Signet 2726-LC version performs better in low conductivity water between 20 - 100 µS and lasts longer than previous "DI" electrodes.

5b. The 2726-LC sensor also performs in applications with extremely low (less than 20 µS) conductivity. Special precautions must be taken to avoid measurement complications.
Please note the following.
- Electrostatic charges (streaming potentials) can cause dramatic offsets in a system with very low conductivity water. To minimize this, sensors should be placed in a well grounded system.
- To enhance performance, a low flow cell is recommended to provide a steady flow rate (150 ml/minute). Sensors placed in high flow applications will experience noisier readings due to streaming potential.

6. Threads for NPT or ISO process connection into reducing tees
    - Use off-the-shelf GF reducing tees DN20 to DN100 (¾ to 4 in.).
7. Mounts directly into Signet fittings (½ in. 4 in.) for easy sensor retrofitting.
8. Mount submersed into a tank via the 2750 or 2760 back threads.

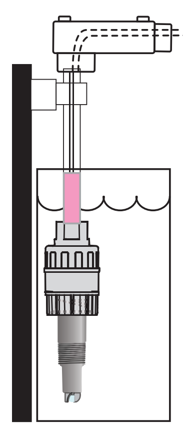


Dual-patented reference design for long life in conductivity or chemicals.



⑥ Sensor in threaded reducing tee

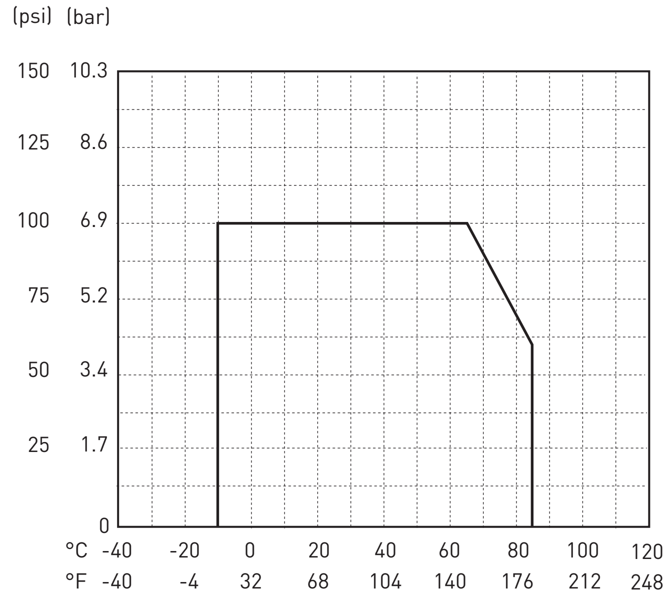
⑦ Sensor in Signet fitting



⑧ Sensor submersible installation

Operating Temperature/Pressure Graph

Note:
The pressure/temperature graphs are specifically for the Signet sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Application Tips

- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals.
- Use bulb protected electrodes for general purpose applications
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

Model 2724-2726 Ordering Notes

1) pH and ORP electrodes require connection to model 2750 sensor electronics or 2760 preamplifier.
2) The 2750 "EasyCal" feature recognizes common pH and ORP buffer values of 4, 7 and 10 pH and +87 and +264 mV for ORP.

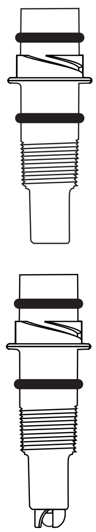
Buffer Solutions
3822-7004
3822-7007
3822-7010

Quinhydrone
3822-7115

The Signet pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.

All pH buffers are color coded for easy identification; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue. All pH buffers are traceable to NIST standards. These buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone.

Ordering Information



Mfr. Part No.	Code	Tip design	Process Connection Thread Options
pH Electrodes			
Temperature element PT1000; use with 2750 sensor electronics*			
3-2724-00	**159 001 545**	Flat	¾ in. MNPT, Thread
3-2724-01	**159 001 546**	Flat	ISO 7/1-R 3/4 Thread
3-2726-00	**159 001 553**	Bulb	¾ in. MNPT, Thread
3-2726-01	**159 001 554**	Bulb	ISO 7/1-R 3/4 Thread
3-2726-HF-00	**159 001 549**	Bulb, HF resistant[1]	¾ in. MNPT, Thread
3-2726-HF-01	**159 001 550**	Bulb, HF resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-LC-00	**159 001 557**	Bulb, Low Conductivity[2]	¾ in. MNPT, Thread
3-2726-LC-01	**159 001 558**	Bulb, Low Conductivity[2]	ISO 7/1-R 3/4 Thread
Temperature element 3 KΩ Balco; use with 2760 preamplifier**			
3-2724-10	**159 001 547**	Flat	¾ in. MNPT, Thread
3-2724-11	**159 001 548**	Flat	ISO 7/1-R 3/4 Thread
3-2726-10	**159 001 555**	Bulb	¾ in. MNPT, Thread
3-2726-11	**159 001 556**	Bulb	ISO 7/1-R 3/4 Thread
3-2726-HF-10	**159 001 551**	Bulb HF resistant[1]	¾ in. MNPT, Thread
3-2726-HF-11	**159 001 552**	Bulb HF resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-LC-10	**159 001 559**	Bulb, Low Conductivity[2]	¾ in. MNPT, Thread
3-2726-LC-11	**159 001 560**	Bulb, Low Conductivity[2]	ISO 7/1-R 3/4 Thread
ORP Electrodes; Compatible with both the 2750 sensor electronics and the 2760 preamplifier			
3-2725-60	**159 001 561**	Flat	¾ in. MNPT, Thread
3-2725-61	**159 001 562**	Flat	ISO 7/1-R 3/4 Thread

*The 2750 sensor electronics has a digital (S³L) output which is used with 8900 or 9900 Instruments. It also has a 4 to 20 mA output for connections to PLC's, data recorders, etc.

**The 2760 preamplifier is used for connection directly to Signet 8750 Transmitter or other analog transmitters.

[1]HF resistant ≤2% HF

[2]Low conductivity applications, 20 - 100 μS/cm recommended

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
1220-0021	**198 801 000**	O-ring, FPM
3-2700.395	**159 001 605**	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 DryLoc® Adapter Cable (for use with 2750 and 2760)
3-0700.390	**198 864 403**	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10.00 buffer solution, 1 pint (473 ml) bottle

3-2724.099 Rev C (5/13)

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efector500

ifm electronic

Pressure sensors

PN2222

Combined pressure sensor
PN22

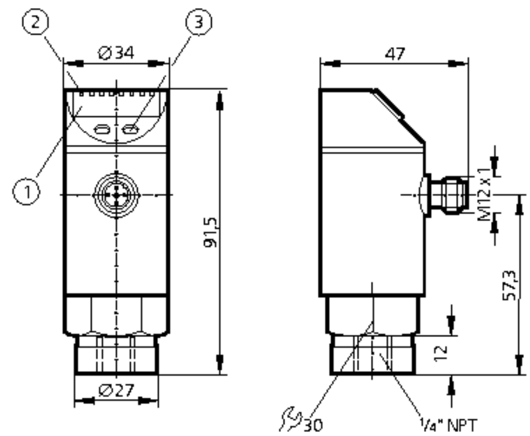
Process connection: ¼" NPT

Zero and span adjustable
Function programmable

2 outputs OUT1 = switching output OUT2 = switching output or analog output

4-digit alphanumeric display

Measuring range
0...1450 PSI
0..100 bar
0...10 MPa



1: 4-digit alphanumeric display 2: LEDs (display unit / switching status) 3: Programming button

Application	**Type of pressure: relative pressure** **Liquids and gases** **For gaseous media the application is limited to max. 363 PSI (25 bar)**
Electrical design	**DC PNP / DC NPN**
Output	**2 x normally open / closed programmable or 1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V; programmable 1:4)**

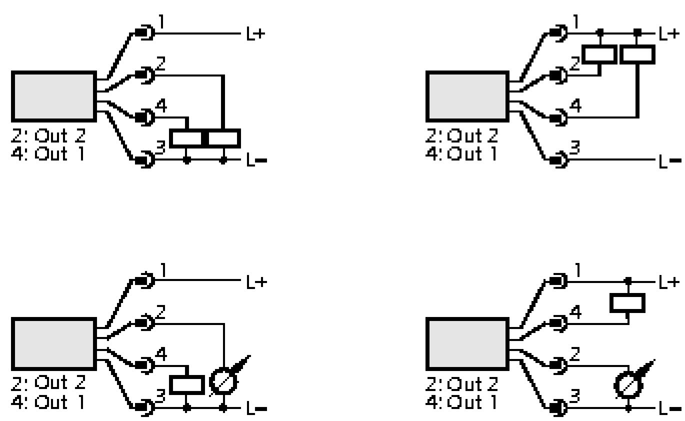
Operating voltage [V]	20...30 DC ¹)
Current rating [mA]	2 x 250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 65

Analog output	4...20 mA / 0...10 V		
Load for analog output [ohms]	4...20 mA: max. (Ub - 10 V) x 50 / 0...10 V: min. 2000		
Permissible overl. pressure	4350 PSI	300 bar	30 MPa
Bursting pressure min.	9400 PSI	650 bar	65 MPa
Setting range			
Switch-on point, SP	12...1450 PSI	0.8...100.0 bar	0.08...10.00 MPa
Switch-off point, rP	6...1444 PSI	0.4...99.6 bar	0.04...9.96 MPa
Analog output/lower end, ASP	0...580 PSI	0.0...40.0 bar	0.00...4.00 MPa
Analog output/upper end, AEP	364...1450 PSI	25.0...100.0 bar	2.50...10.00 MPa
in steps of	2 PSI	0.2 bar	0.02 MPa
Programming options	hysteresis / window function; N.O. / N.C; output polarity; current / voltage outputs; damping; calibration of displayed values; display can be rotated / deactivated; display unit		

Accuracy / deviations	
(in % of the span)	
Turn down 1:1	
Accuracy of switch point	
Characteristics deviation *)	
Linearity	< ± 0.5
Hysteresis	< ± 0.6
Repeatability **)	< ± 0.5
Long-term stability ***)	< ± 0.1
Temperature coefficients	< ± 0.1

(TEMPCO) in the temperature range 0...80 °C (in% of the span per 10 K)	< ± 0.1
- greatest TEMPCO of the zero point - greatest TEMPCO of the span	< ± 0.1 < ± 0.2
Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Damping for the switching output (dAP) [ms]	0; 10; 20;...100; 200;...4000
Switching frequency [Hz]	170...0.125
Response time analog output [ms]	3
Damping for the analog output (dAA) [ms]	0; 100; 500; 2000

PN2222

Operating temperature [°C]	-25...80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
Protection	IP 67 (IEC 60529) / (UL50), III (EN 50178)
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 0.5/1 kV EN 61000-4-6 HF conducted: 10 V
Housing material	stainless steel (304S15); stainless steel (316S12); PC (Macrolon); PBT (Pocan); PEI; FPM (Viton); EPDM/X (Santoprene)
Materials (wetted parts)	stainless steel (303S22); ceramics; FPM (Viton)
Function display Switching status LED Power LED System pressure, function LED	 2 x yellow 3 x green (display unit) 4-digit alphanumeric display
Connection	M12 connector; gold-plated contacts
Wiring Programming of the output function (OUT1 / OUT2): Hno = hysteresis / normally open Hnc = hysteresis / normally closed Fno = window function / normally open Fnc = window function / normally closed Complementary outputs: output 1: = Hno, output 2: = Hnc (with the same SP / rP) Programming of the analog output (OUT2): I = current output (4...20 mA) U = voltage output (0...10 V) 	
Remarks	[1]) to EN50178, SELV, PELV; referring to UL: “limited voltage” with overcurrent protection in accordance with UL508 *) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086) **) with temperature fluctuations < 10 K ***) in % of the span per year

efectorsoo

ifm electronic

Pressure sensors

PN2228

Combined pressure sensor
PN22

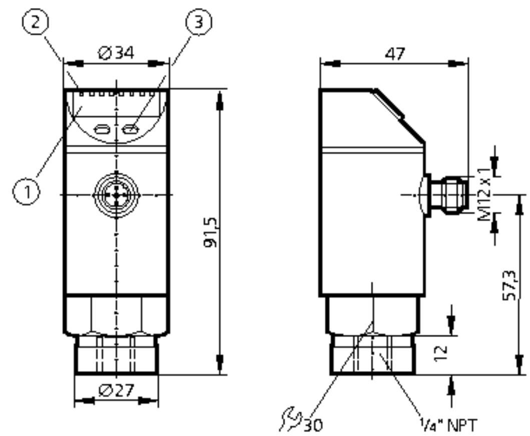
Process connection: ¼" NPT

Display units:
mbar, kPa, inH2O, mmWS
Zero and span adjustable
Function programmable

2 outputs OUT1 = switching output OUT2 = switching output or analog output

4-digit alphanumeric display

Measuring range
-5.0...100.4 inH2O



1: 4-digit alphanumeric display 2: LEDs (display unit / switching status) 3: Programming button

Application	**Type of pressure: relative pressure Liquids and gases**
Electrical design	**DC PNP / DC NPN**
Output	**2 x normally open / closed programmable or 1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V; programmable 1:4)**
Operating voltage [V]	20...30 DC ¹)
Current rating [mA]	2 x 250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 65
Analog output	4...20 mA / 0...10 V
Load for analog output [ohms]	4...20 mA: max. (Ub - 10 V) x 50 / 0...10 V: min. 2000
Permissible overl. pressure [inH2O]	4000
Bursting pressure min. [inH2O]	12000
Setting range	
Switch-on point, SP [inH2O]	-4.2...100.4
Switch-off point, rP [inH2O]	-4.6...100.0
Analog output/lower end, ASP [inH2O]	-5.0...40.2
Analog output/upper end, AEP [inH2O]	20.0...100.4
in steps of [inH2O]	0.2
Programming options	hysteresis / window function; N.O. / N.C; output polarity; current / voltage outputs; damping; calibration of displayed values; display can be rotated / deactivated; display unit

Accuracy / deviations (in % of the span)	
Turn down 1:1	
Accuracy of switch point	
Characteristics deviation *)	
Linearity	< ± 0.5
Hysteresis	< ± 0.6
Repeatability **)	< ± 0.5

Long-term stability ***)	< ± 0.1
Temperature coefficients (TEMPCO) in the temperature range 0...80 °C (in% of the span per 10 K)	< ± 0.1 < ± 0.1
- greatest TEMPCO of the zero point	< ± 0.2
- greatest TEMPCO of the span	< ± 0.2
Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Damping for the switching output (dAP) [ms]	0; 10; 20;...100; 200;...4000
Switching frequency [Hz]	170...0.125
Response time analog output [ms]	3
Damping for the analog output (dAA) [ms]	0; 100; 500; 2000

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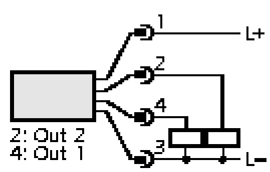
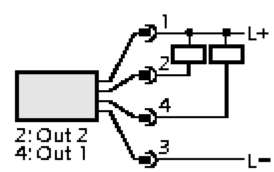
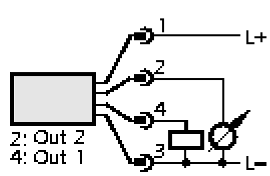
ifm electronic

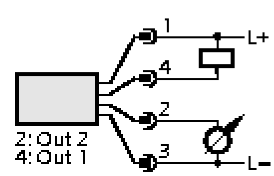
PN2228

Operating temperature [°C]	-25...80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
Protection	IP 65 (IEC 60529) / (UL50), III (EN 50178)
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 0.5/1 kV EN 61000-4-6 HF conducted: 10 V
Housing material	stainless steel (304S15); stainless steel (316S12); PC (Macrolon); PBT (Pocan); PEI; FPM (Viton); EPDM/X (Santoprene); PTFE
Materials (wetted parts)	stainless steel (303S22); ceramics; FPM (Viton)
Function display Switching status LED Power LED System pressure, function LED	 2 x yellow 4 x green (display unit) 4-digit alphanumeric display
Connection	M12 connector; gold-plated contacts
Wiring Programming of the output function (OUT1 / OUT2): Hno = hysteresis / normally open Hnc = hysteresis / normally closed Fno = window function / normally open Fnc = window function / normally closed Complementary outputs: output 1: = Hno, output 2: = Hnc (with the same SP / rP) Programming of the analog output (OUT2): I = current output (4...20 mA) U = voltage output (0...10 V)	
Remarks	¹) to EN50178, SELV, PELV; referring to UL: “limited voltage” with overcurrent protection in accordance with UL508 *) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086) **) with temperature fluctuations < 10 K ***) in % of the span per year









efector600

ifm electronic

Temperature sensors

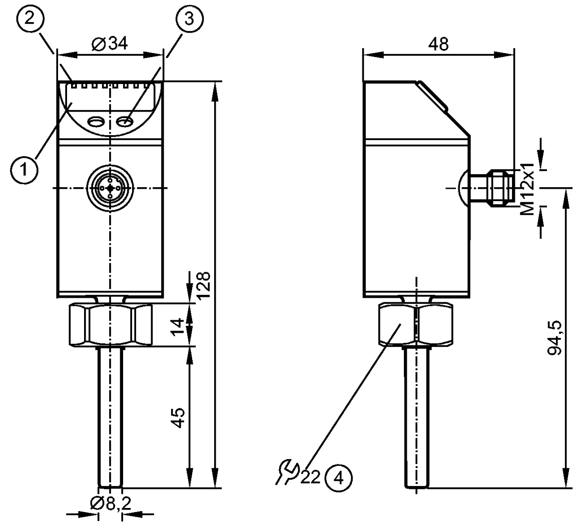
TN2531

Electronic temperature sensor
TN

Compact type for adapter
Quick disconnect
Process connection:
internal thread M18 x 1.5 for adapter

Communication interface: IO-Link 1.0
(COM2 slave, 38.4 kBaud)

Switching output, analog output 4...20 mA or 0...10 V
4-digit alphanumeric display
Measuring range
-40...150 °C / -40...302 °F



1: 4-digit alphanumeric display
2: LEDs
3: Programming button
4: internal thread M18 x 1.5

Made in Germany

CE c UL us LISTED

Application	**liquids and gases**
Electrical design	**DC PNP/NPN**
Output	**1 x normally open / closed programmable + 1 x analog (4...20 mA / 0...10 V, scalable)**
Probe length L [mm]	**45**
Operating voltage [V]	18...32 DC
Current rating [mA]	250
Short-circuit protection	Yes (non-latching)
Reverse polarity protection	yes
Overload protection	yes
Integrated watchdog	yes
Voltage drop [V]	< 2
Current consumption [mA]	< 50
Analog output	4...20 mA / 0...10 V
Pressure rating [bar]	300
Setting range	
Analog start point, ASP [°C/°F]	-40.0...145.0 / -40.0...293.0
Analog end point, AEP [°C/°F]	-35; 0...150; 0 / -31; 0...302; 0
Set point, SP [°C/°F]	-39.5...150.0 / -39.0...302.0
Reset point, rP [°C/°F]	-40.0...149.5 / -40.0...301.0
in steps of [°C/°F]	0.1 / 0.1
Adjustment of the switch point	Programming button
Accuracy	
Switching output [K]	± 0.3
Analog output [K]	± 0.3
Display [K]	± 0.3
Resolution	
Switching output [K]	0.1
Analog output [K]	< 0.1
Display [K]	0.1
Temperature drift (/ 10 K)	0.1
Power-on delay time [s]	1

efector600

ifm electronic

TN2531

Measuring / display cycle [ms]	[ms]	200
Measuring element		1 x Pt 1000, to DIN EN 60751, class B
Dynamic response	T05 / T09 [s]	1 / 3 *)
Minimum installation depth	[mm]	12

efector600

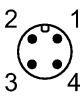
ifm electronic

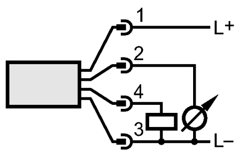
TN2531

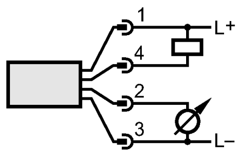
Ambient temperature [°C]	-25...70
Storage temperature [°C]	-40...100
Protection	IP 67, III
Insulation resistance [MΩ]	> 100 / 500 V DC
Shock resistance	DIN IEC 68-2-27:50 g (11 ms)
Vibration resistance	DIN EN 60068-2-6:20 g (10...2000 Hz)
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 1 kV EN 61000-4-6 HF conducted: 10 V
Housing materials	stainless steel (304S15); PBT (Pocan); PC (Makrolon); EPDM/X (Santoprene); FPM (Viton)
Materials (wetted parts)	stainless steel 316L / 1.4404
Display	Display unit 2 x LED green Switching status LED yellow Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display
Connection	M12 connector; gold-plated contacts
Weight [kg]	0.19
Remarks	cULus - Class 2 source required *) according to DIN EN 60751 The values for accuracy apply to flowing water. load for current output: Rmax [Ω]: (Ub - 10 V) x 50 / for voltage output: Rmin [Ω]: 2000

Wiring

Programming of the output function:
Hno = hysteresis / N.O.
Hnc = hysteresis / N.C.
Fno = window function / N.O.
Fnc = window function / N.C.







efector600

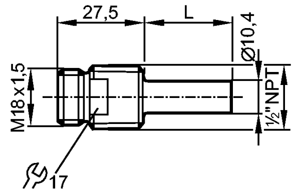
ifm electronic

Accessories

UT0028

½" NPT

Thermowell for temperature sensors



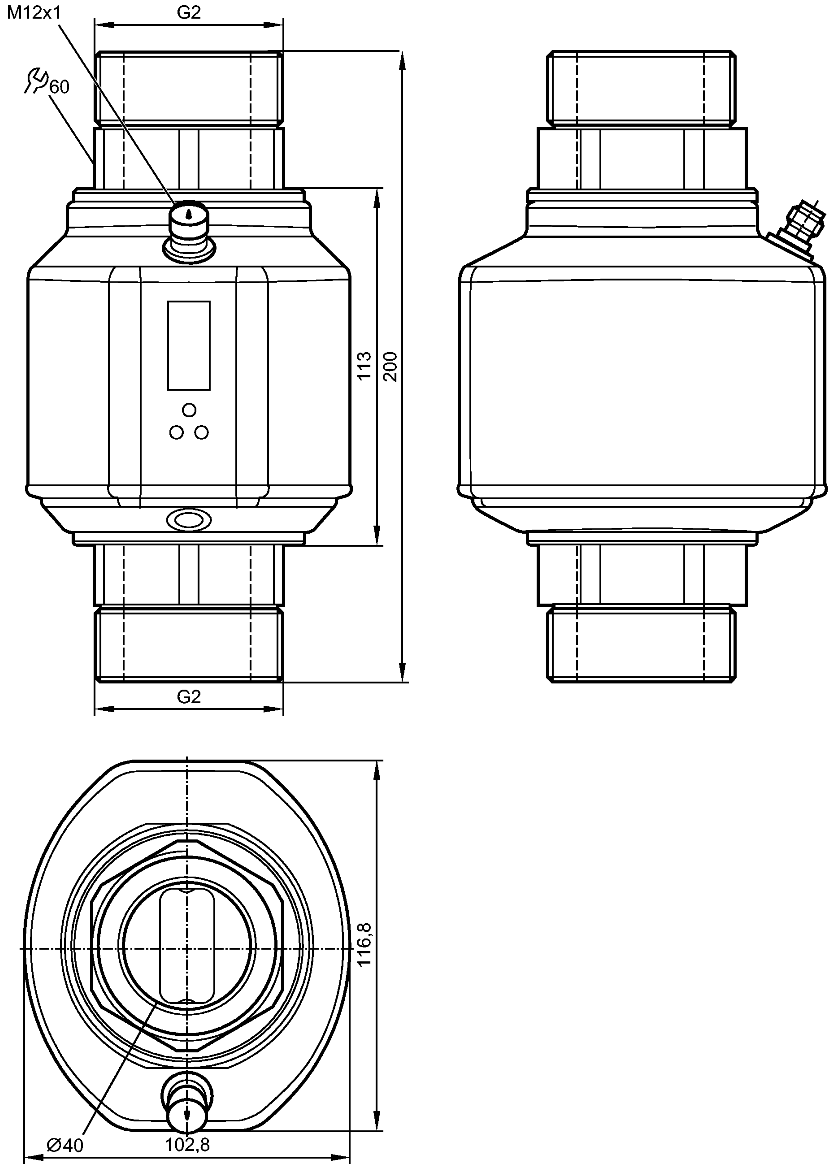
Probe length L [mm]	27
Design	for types TN
Pressure rating [bar]	16
Inside diameter [mm]	8.4
Process connection	½" NPT
Housing materials	stainless steel (316)
Accessories (optional)	heat conductive paste order no. 700692

efector300

SM2004

SMR21XGX50KG/US

Flow sensors



Made in Germany

IO-Link

Product characteristics
Magnetic-inductive flow meter
Quick disconnect
Process connection: G2 flat seal
connection to pipe by means of an adapter
Empty pipe detection
2 outputs
OUT1 = analogue signal temperature OUT2 = analogue signal flow
4-digit alphanumeric display
Display units: l/min, m³/h, gpm, gph, °C, °F
Measuring range
5...600 l/min (1.3...158.5 gpm)
-20...80 °C (-4...176 °F)

Application

efector300

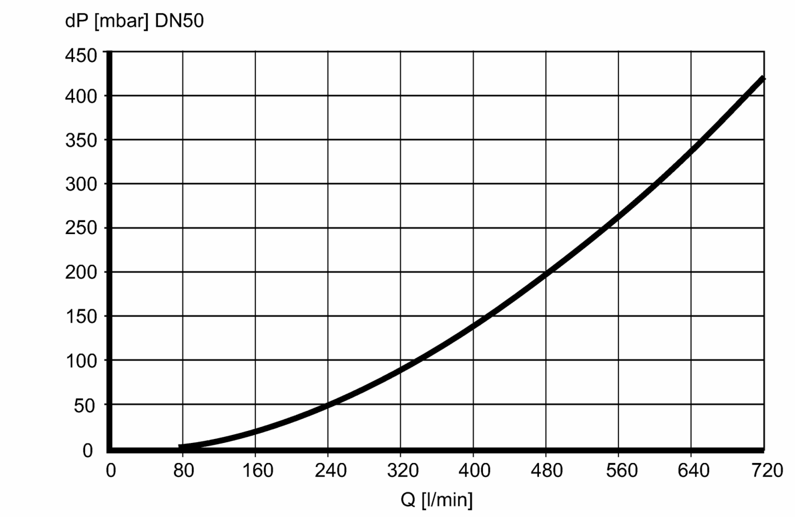
SM2004

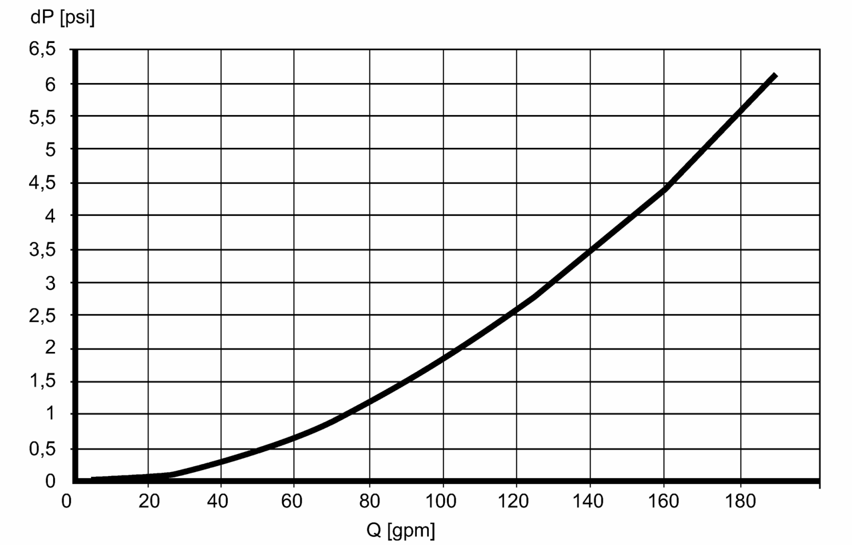
SMR21XGX50KG/US

Flow sensors

Application		Conductive liquids (conductivity:>= 20 µS/cm / viscosity: < 70 cSt at 104 °F)			
Medium temperature	[°C / °F]	-10...70 / 14...158			
Electrical data					
Electrical design		DC			
Operating voltage	[V]	18...32 DC [1])			
Current consumption	[mA]	< 150			
Insulation resistance	[MΩ]	> 100 (500 V DC)			
Protection class		III			
Reverse polarity protection		yes			
Outputs					
Output function		OUT1: analog (4…20 mA) oder IO-Link [2]) OUT2: analog (4…20 mA)			
Analog output		4...20 mA; ≤ 22 mA			
Max. load	[Ω]	500			
Measuring / setting range					
Flow monitoring					
Measuring range		5...600 l/min	0.3...36 m³/h	80...9510 gph	1.3...158.5 gpm
Display range		-720...720 l/min	-43.2...43.2 m³/h	-11410...11410 gph	-190.2...190.2 gpm
Resolution		0.5 l/min	0.02 m³/h	5 gph	0.1 gpm
Analog start point, ASP		0...480 l/min	0...28.8 m³/h	0...7610 gph	0...126.8 gpm
Analog end point, AEP		120...600 l/min	7.2...36 m³/h	1900...9510 gph	31.7...158.5 gpm
Low flow cut-off, LFC		5...15 l/min; 0.3...0.9 m³/h; 80...240 gph; 1.3…4 gpm			
in steps of		0.5 l/min	0.02 m³/h	5 gph	0.1 gpm
Measuring dynamics		1:120			
Temperature monitoring					
Measuring range	[°C / °F]	-20...80 / -4...176			
Display range	[°C / °F]	-40...100 / -40...212			
Resolution	[°C / °F]	0.2 / 0.5			
Analog start point, ASP	[°C / °F]	-20...60 / -4...140			
Analog end point, AEP	[°C / °F]	0...80 / 32...176			
in steps of	[°C / °F]	0.2 / 0.5			
Accuracy / deviations					
Flow monitoring					
Accuracy	[% of the final value]	± (0.8% MW + 0.5% MEW) [3])			
Repeatability		± 0.2% MEW			

Pressure loss (dP) / flow rate (Q)





Temperature monitoring		
Accuracy	[K]	± 1 (25 °C; Q > 15 l/min) / ± 1 (77 °F; Q > 4 gpm)
Reaction times		
Power-on delay time	[s]	5
Flow monitoring		
Response time	[s]	< 0.25 (dAP = 0)
Damping, dAP	[s]	0...5
Temperature monitoring		
Response time	[s]	T09 = 3 (Q > 15 l/min) / T09 = 3 (Q > 4 gpm)
Software / programming		
Programming options		Display abschaltbar; Anzeigeeinheit; Leerrohr-Erkennung
Interfaces		
IO-Link Device		
Transfer type		COM2 (38.4 kBaud)
IO-Link revision		1.1
SDCI standard		IEC 61131-9 FDIS
IO-Link Device ID		379 d / 00 01 7B h
Profiles		Smart Sensor: Process Data Variable; Device Identification
SIO mode		no

efector300®

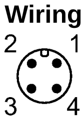
SM2004

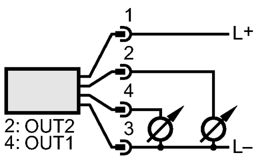
SMR21XGX50KG/US

Flow sensors

Required master port class	A
Process data analogue	3
Process data binary	2
Min. process cycle time [ms]	5
Environment	
Pressure rating [psi]	232
Ambient temperature [°C / °F]	-10...60 / 14...140
Storage temperature [°C / °F]	-25...80 / -13...176
Protection	IP 65 / IP 67
Tests / approvals	
EC pressure equipment directive 97/23/EC	article 3, paragraph (3) - sound engineering practice
EMC	DIN EN 60947-5-9
Shock resistance	DIN EN 60068-2-27: 20 g (11 ms)
Vibration resistance	DIN EN 60068-2-6: 5 g (10...2000 Hz)
Mechanical data	
Process connection	G2 flat seal
Materials (wetted parts)	stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PEEK (polyether ether ketone); Hastelloy C-4 (2.4610); Centellen; FKM
Housing materials	stainless steel 316L / 1.4404; stainless steel 316Ti / 1.4571; PC (polycarbonate); FKM; PBT-GF 20; elastolan
Weight [kg]	3.065
Displays / operating elements	
Display	Display unit 6 x LED green (l/min, m³/h, gpm, gph, °C, °F) Function display 1 x LED yellow (10³) Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display
Electrical connection	
Connection	M12 connector; gold-plated contacts

Wiring





Pin 2: Flow monitoring
Pin 4: Temperature monitoring
Pin 4: IO-Link ²)

Accessories	
Accessories (included)	2 x packing washer (Centellen); Label
Remarks	
Remarks	¹) to DIN EN 50178, SELV, PELV ²) IO-Link communication must be activated in the menu. ³) Q > 15l/min, medium and ambient temperature +22 °C ± 4K (+72 °F ± 7 °F) MW = measured value MEW = final value of the measuring range

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SM2004

SMR21XGX50KG/US

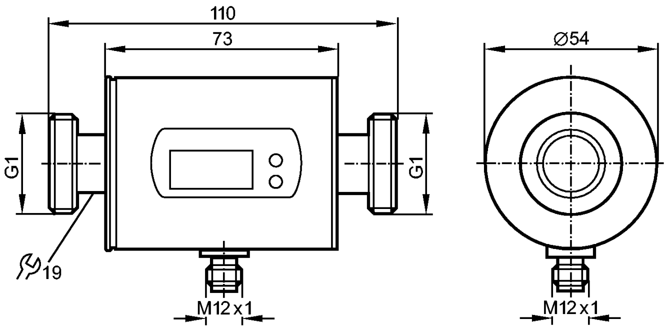
Flow sensors

Pack quantity	[piece]	1
Other data		
Temperature drift		± 0.0333 °C / K; ± 0.0599 °F / K

SM0504

SMR11GGX50KG/US100

Flow sensors



CE

Made in Germany

Product characteristics
Magnetic-inductive flow meter
Quick disconnect
Process connection: G1 flat seal
2 outputs
OUT1 = analogue signal temperature OUT2 = analogue signal flow
Display units:
l/min, m³/h, gpm, gph
°C / °F
connection to pipe by means of an adapter

Application		
Application		Conductive liquids (conductivity:>= 20 µS/cm / viscosity: < 70 cSt at 104 °F)
Medium temperature	[°F]	14...158

Electrical data		
Electrical design		DC
Operating voltage	[V]	20...30 DC ¹)
Current consumption	[mA]	120 (24 V)
Insulation resistance	[MΩ]	> 100 (500 V DC)
Protection class		III
Reverse polarity protection		yes

Outputs		
Output function		2 x analog (4...20 mA scalable)
Overload protection		yes
Analog output		4...20 mA, max. 22 mA
Max. load	[Ω]	max. 500

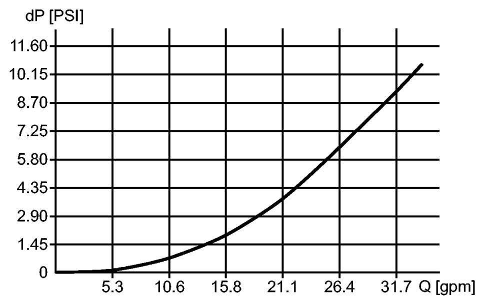
Measuring / setting range		
Flow monitoring		
Measuring range	0.10...30.00 gpm	6...1800 gph
Display range	-31.70...31.70 gpm	-1902...1902 gph
Resolution	0.05 gpm	2 gph
Analog start point, ASP	0.00...21.15 gpm	0...1268 gph
Analog end point, AEP	5.30...30.00 gpm	318...1800 gph
in steps of	0.05 gpm	2 gph
Temperature monitoring		

efector300

SM0504

SMR11GGX50KG/US100

Flow sensors

Measuring range	[°F]	-4...176
Resolution	[°F]	0.5
Analog start point, ASP	[°F]	-4.0...140.5
Analog end point, AEP	[°F]	31.5...176.0
in steps of	[°F]	0.5
Accuracy / deviations		
Flow monitoring		
Accuracy	[% of the final value]	± (2% MW + 0.5% MEW)
Repeatability		± 0.2% MEW
Pressure loss (dP) / flow rate (Q)		
Temperature monitoring		
Accuracy	[K]	± 4.5 (Q > 0.26 gpm)
Reaction times		
Power-on delay time	[s]	5
Flow monitoring		
Response time	[s]	< 0.150 (dAP = 0)
Damping, dAP	[s]	0.0...5.0
Temperature monitoring		
Response time	[s]	T09 = 30 (Q > 0.26 gpm)
Environment		
Pressure rating	[psi]	232
Ambient temperature	[°F]	14...140
Storage temperature	[°F]	-13...176
Protection		IP 67
Tests / approvals		
EMC		EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-5 Surge: 0.5 kV EN 61000-4-6 HF conducted: 10 V
Shock resistance		DIN IEC 68-2-27: 20 g (11 ms)
Vibration resistance		DIN IEC 68-2-6: 5 g (10...2000 Hz)
MTTF	[Years]	175
Mechanical data		
Process connection		G1 flat seal
Materials (wetted parts)		stainless steel 316L / 1.4404; PEEK (polyether ether ketone); FKM
Housing materials		stainless steel 316L / 1.4404; PBT-GF 20; PC (Makrolon); EPDM/X (Santoprene)
Weight	[kg]	0.593
Displays / operating elements		

efector300®

SM0504

SMR11GGX50KG/US100

Flow sensors

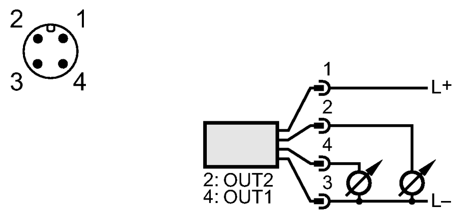
Display	Display unit 6 x LED green (l/min, m³/h, gpm, gph, °C, °F) Measured values 4-digit alphanumeric display Programming 4-digit alphanumeric display

Electrical connection

Connection	M12 connector; gold-plated contacts

Wiring

OUT1 = analogue signal temperature
OUT2 = analogue signal flow



Remarks

Remarks	[1]) to EN50178, SELV, PELV MW = measured value MEW = final value of the measuring range
Pack quantity [piece]	1

SDL Project - System Valves Totals									
Valve #	Type of Action	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
2	Pneumatic Spring Return	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
18	Pneumatic Spring Return	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
2	Pneumatic Spring Return	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
3	Pneumatic Spring Return	40	1-1/2"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
2	Pneumatic Spring Return	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
1	Flow Control Valve	50	2"	316 SS	3 pc SW	V320SSFFFA50	ALF30-SR	V100E	FloTite/Alpha/BLX
2	Flow Control Valve	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
4	Swing Check Valve	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
1	Swing Check Valve	40	1-1/2"	CPVC	3 pc SW	TC 2150ST	None	None	Hayward
6	Manual Ball Valve	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
8	Manual Ball Valve	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
26	Manual Ball Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
5	Manual Ball Valve	25	1"	CPVC	1 pc SW	TB2200ST	None	None	Hayward
1	Manual Globe Valve	40	1-1/2"	316 SS	NPT	GB-200	None	None	JFW VALVE
51	Valve Totals								
Note: Does not include off-skid equipment.									

SDL Project - Valves List

Stage-1 VSEP RO Skid

Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-100	Pneumatic Spring Return	Hot Water Inlet to Bag Filter	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
XV-101	Pneumatic Spring Return	Feed Inlet to Bag Filter	63	2.5"	316 SS	3 pc SW	320SSFFFA63	ALF35-SR	None	FloTite/Alpha
XV-102	Pneumatic Spring Return	Feed to Header	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-105	Pneumatic Spring Return	Permeate to VSEP Feed Tank, T-110	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-106	Pneumatic Spring Return	Permeate to Tank, T-130	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-107	Pneumatic Spring Return	Concentrate to VSEP Feed Tank, T-110	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-108	Pneumatic Spring Return	Concentrate to Reject Tank, T-120	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-110	Pneumatic Spring Return	CIP Feed to VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-111	Pneumatic Spring Return	CIP Permeate From VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-112	Pneumatic Spring Return	Permeate From VSEP #1	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-113	Pneumatic Spring Return	CIP Concentrate From VSEP #1	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
XV-114	Pneumatic Spring Return	Concentrate From VSEP #1	25	1"	316 SS	3 pc SW	320SSFFFA25	ALF20-SR	None	FloTite/Alpha
FCV-110	Flow Control Valve	Feed to VSEP #1	50	2"	316 SS	3 pc SW	V320SSFFFA50	ALF30-SR	V100E	FloTite/Alpha/BLX
FCV-112	Flow Control Valve	Concentrate from VSEP #1	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
CV-110	Swing Check Valve	Permeate Return #1	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
MV-100	Manual Ball Valve	Bag Filter #100 Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-101	Manual Ball Valve	Bag Filter #101 Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-103	Manual Ball Valve	Bag Filter #100 Outlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-104	Manual Ball Valve	Bag Filter #101 Outlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-106	Manual Ball Valve	Feed Pump, P-100/101Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-109	Manual Ball Valve	Bag Filter #100 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1010	Manual Ball Valve	Bag Filter #101 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1012	Manual Ball Valve	Bag Filter, BF-100 Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1013	Manual Ball Valve	Bag Filter, BF-101 Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1015	Manual Ball Valve	Feed Pump, P-100-101 Inlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-1018	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-1019	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-170	Manual Ball Valve	Feed #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-171	Manual Ball Valve	Permeate #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-172	Manual Ball Valve	Concentrate #1 Drain Port	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
			Qty							
	Isolation Manual Ball Valve	Instruments-PIT	4	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PDT	2	1/4"	316 SS	NPT	T80SS	None	None	FloTite

Stage 2 - Spiral RO Skid

Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-200	Pneumatic Spring Return	Hot water in	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
XV-201	Pneumatic Spring Return	Feed to Spiral from feed tank	50	2"	CPVC	3 pc SW	TB2200ST	ALF30-SR	None	Hayward/Alpha
XV-202	Pneumatic Spring Return	Feed Pump, P-201 Outlet	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-203	Pneumatic Spring Return	Feed In from CIP Skid	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-205	Pneumatic Spring Return	Spiral Permeate out to CIP Skid	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-206	Pneumatic Spring Return	Spiral Permeate to Destination, T-300	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-207	Pneumatic Spring Return	Spiral Permeate to Feed Tank, T-200/210	40	1.5"	CPVC	3 pc SW	TB2150ST	ALF25-SR	None	Hayward/Alpha
XV-204	Pneumatic Spring Return	Spiral Concentrate out to CIP Skid	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
XV-208	Pneumatic Spring Return	Spiral Concentrate to Reject Tank, T-120	25	1"	CPVC	3 pc SW	TB2100ST	ALF20-SR	None	Hayward/Alpha
FCV-200	Flow Control Valve	Concentrate from Spiral	25	1"	316 SS	3 pc SW	V320SSFFFA25	ALF25-SR	V100E	FloTite/Alpha/BLX
CV-201	Swing Check Valve	Permeate from Spiral RO	40	1.5"	CPVC	3 pc SW	TC 2150ST	None	None	Hayward
MV-200	Manual Ball Valve	Feed Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite

MV-201	Manual Ball Valve	Bag Filter, BF-200 Inlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-202	Manual Ball Valve	Bag Filter, BF-201 Inlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-203	Manual Ball Valve	Bag Filter, BF-200 Outlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-204	Manual Ball Valve	Bag Filter, BF-201 Outlet	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-205	Manual Ball Valve	Bag Filter Drain	25	1"	CPVC	3 pc SW	TB2100ST	None	None	Hayward
MV-208	Manual Globe Valve	Permeate from stage-1	40	1-1/2"	316 SS		GB-200	None	None	JFW VALVE
MV-2010	Manual Ball Valve	Bag Filter #200 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2011	Manual Ball Valve	Bag Filter #201 Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2017	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-2018	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PIT	3	1/4"	316 SS	NPT	T80SS	None	None	FloTite
	Isolation Manual Ball Valve	Instruments-PDT	2	1/4"	316 SS	NPT	T80SS	None	None	FloTite
CIP Skid										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-190	Pneumatic Spring Return	Hot Water to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-191	Pneumatic Spring Return	Hot Water to VSEP	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-192	Pneumatic Spring Return	CIP Tank to Drain	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-193	Pneumatic Spring Return	CIP Tank to Pump	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-194	Pneumatic Spring Return	CIP Pump to Feed Header	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-195	Pneumatic Spring Return	Feed Bypass to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-196	Pneumatic Spring Return	Permeate to CIP Tank	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-197	Pneumatic Spring Return	Permeate to Destination	50	2"	316 SS	3 pc SW	320SSFFFA50	ALF30-SR	None	FloTite/Alpha
XV-198	Pneumatic Spring Return	Concentrate to CIP Tank	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
XV-199	Pneumatic Spring Return	Concentrate to Destination	40	1-1/2"	316 SS	3 pc SW	320SSFFFA40	ALF25-SR	None	FloTite/Alpha
CV-190	Swing Check Valve	Hot Water In	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
CV-191	Swing Check Valve	Bag Filter Inlet	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
CV-192	Swing Check Valve	Bag Filter Inlet	50	2"	316 SS	SW	SC-200SW	None	None	JFW VALVE
MV-190	Manual Ball Valve	Bag Filter Inlet	50	2"	316 SS	3 pc SW	320SSFFFL50	None	None	FloTite
MV-191	Manual Ball Valve	Bag Filter Bleed Valve	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-192	Manual Ball Valve	Feed Pump Inlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-193	Manual Ball Valve	Pump Outlet to Drain	16	1/2"	316 SS	NPT	T80SS	None	None	FloTite
MV-194	Manual Ball Valve	Permeate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-195	Manual Ball Valve	Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
MV-196	Manual Ball Valve	IC Feed Sample Port	8	1/4"	317 SS	NPT	T80SS	None	None	FloTite
MV-197	Manual Ball Valve	IC Permeate Sample Port	8	1/4"	318 SS	NPT	T80SS	None	None	FloTite
MV-198	Manual Ball Valve	IC Concentrate Sample Port	8	1/4"	316 SS	NPT	T80SS	None	None	FloTite
Off-Skid Valves (provided by others)										
Tag #	Type of Action	Location	Size	Equal	Material	Connection	Valve Part #	Actuator Part #	Positioner Part #	Manufacturer
XV-210	Pneumatic Spring Return	Tank T-200 to Spiral Skid	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-211	Pneumatic Spring Return	Tank T-210 to Spiral Skid	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-300	Pneumatic Spring Return	Spiral Permeate to Hot Water Tank	51	2"	CPVC	4 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA
XV-301	Pneumatic Spring Return	Spiral Permeate to Discharge	50	2"	CPVC	3 pc S/T	TB2200ST	ALF20-SR	None	Hayward/ALPHA

SDL Project - Valves Calculations

Stage-1 VSEP RO Skid													
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
Modulated Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
FCV-110	Feed to VSEP #1	50	2"	2.066	3.351	15.0	30.0	37.5	500	1.34	1.68	3.59	1.09
FCV-112	Concentrate from VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	500	0.89	1.12	9.29	2.83
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
On/Off Pneumatic Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-100	Hot Water Inlet to Bag Filter	63	2.5"	4.000	12.560	30.0	60.0	75.0	5	26.83	33.54	1.92	0.58
XV-101	Feed Inlet to Bag Filter	63	2.5"	4.000	12.560	17.5	35.0	43.8	5	15.65	19.57	1.12	0.34
XV-102	Feed to Header	50	2"	2.583	5.237	17.5	35.0	43.8	5	15.65	19.57	2.68	0.82
XV-105	Permeate to VSEP Feed Tank, T-110	50	2"	3.000	7.065	6.5	13.0	16.3	5	5.81	7.27	0.74	0.23
XV-106	Permeate to Spiral Feed Tank, T-200	50	2"	3.000	7.065	6.5	13.0	16.3	5	5.81	7.27	0.74	0.23
XV-107	Concentrate to VSEP Feed Tank, T-110	50	2"	2.066	3.351	10.0	20.0	25.0	5	8.94	11.18	2.40	0.73
XV-108	Concentrate to Reject Tank, T-120	50	2"	2.066	3.351	10.0	20.0	25.0	5	8.94	11.18	2.40	0.73
XV-110	CIP Feed to VSEP #1	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-111	CIP Permeate From VSEP #1	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-112	Permeate From VSEP #1	50	2"	2.066	3.351	6.5	13.0	16.3	5	5.81	7.27	1.56	0.47
XV-113	CIP Concentrate From VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	5	8.94	11.18	9.29	2.83
XV-114	Concentrate From VSEP #1	25	1"	1.049	.864	10.0	20.0	25.0	5	8.94	11.18	9.29	2.83
Stage-2 Spiral RO Skid													
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
Modulated Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
FCV-200	Concentrate from Spiral RO	25	1"	1.049	.864	10.0	20.0	25.0	500	0.89	1.12	9.29	2.83
Control Skid		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
On/Off Pneumatic Valves		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-200	Hot water in	50	2"	2.583	5.237	45.0	90.0	112.5	5	40.25	50.31	6.90	2.10
XV-201	Feed to Spiral from feed tank	50	2"	2.583	5.237	25.0	50.0	62.5	5	22.36	27.95	3.83	1.17
XV-202	Feed Pump, P-201 Outlet	50	2"	2.583	5.237	25.0	50.0	62.5	5	22.36	27.95	3.83	1.17
XV-203	Feed In from CIP Skid	50	2"	2.583	5.237	45.0	90.0	112.5	5	40.25	50.31	6.90	2.10
XV-205	Spiral Permeate out to CIP Skid	40	1.5"	1.612	2.040	37.5	75.0	93.8	5	33.54	41.93	14.75	4.50
XV-206	Spiral Permeate to Destination, T-300	40	1.5"	1.612	2.040	18.8	37.5	46.9	5	16.77	20.96	7.38	2.25
XV-207	Spiral Permeate to Feed Tank, T-200/210	40	1.5"	1.612	2.040	18.8	37.5	46.9	5	16.77	20.96	7.38	2.25
XV-204	Spiral Concentrate out to CIP Skid	25	1"	1.049	.864	7.5	15.0	18.8	5	6.71	8.39	6.97	2.12
XV-208	Spiral Concentrate to Reject Tank, T-120	25	1"	1.049	.864	6.3	12.5	15.6	5	5.59	6.99	5.81	1.77
CIP Skid													
		mm	US Equal	Inches		Q	Q	Q	ΔP	Cv	Cv	max fps	max M/s
		Nom Size	Nom Size	ID	Area	Min GPM	Nom GPM	Max GPM	Delta PSI	Nominal	Max	Velocity	Velocity
XV-190	Hot Water to CIP Tank	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-191	Hot Water to VSEP	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-192	CIP Tank to Drain	50	2"	2.066	3.351	2.5	5.0	6.3	5	2.24	2.80	0.60	0.18
XV-193	CIP Tank to Pump	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-194	CIP Pump to Feed Header	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-195	Feed Bypass to CIP Tank	50	2"	2.066	3.351	30.0	60.0	75.0	5	26.83	33.54	7.19	2.19
XV-196	Permeate to CIP Tank	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-197	Permeate to Destination	50	2"	2.066	3.351	20.0	40.0	50.0	5	17.89	22.36	4.79	1.46
XV-198	Concentrate to CIP Tank	40	1-1/2"	1.612	2.040	10.0	20.0	25.0	5	8.94	11.18	3.93	1.20
XV-199	Concentrate to Destination	40	1-1/2"	1.612	2.040	10.0	20.0	25.0	5	8.94	11.18	3.93	1.20

FLO-TITE™ valves & controls

2PC Full Bore Economical Ball Valve

2PC ECONOFLO SERIES

Model : T80SS

1000 WOG / 150 SWP
316 Stainless Steel
Optional Carbon Steel

Temperature Range:
-20 °F to 450 °F
-46 °C to 232 °C

Size Range:
1/4” - 3”
Threaded Ends

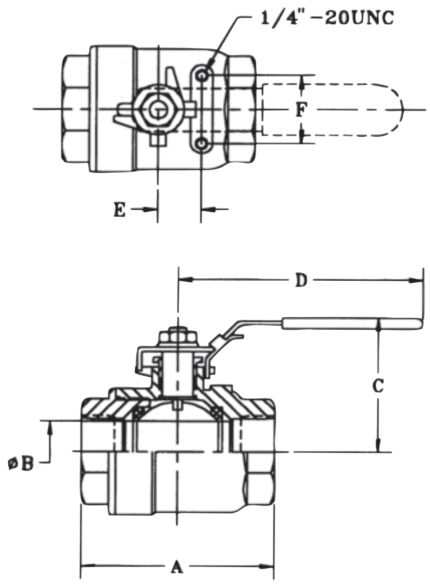
DESIGN FEATURES

- Full Port - Straight through flow minimizes pressure drop and prolongs valve life
- Internal Entry Blow-out Proof Stem
- Locking Handle - Standard on all valves meets OSHA 1910.147
- Adjustable V-Ring Stem Packing
- Bubble Tight - Zero Leakage
- Actuator Mounting Pad
- Investment cast improves dimensional control and reduces porosity
- 2PC Econoflo Series is an Ideal General purpose stainless steel valve, meeting plant - wide applications

Econoflo Series offers exceptional economy and proven performance

FLO TITE
valves & controls

T80SS Full Port Ball Valve Design & Technical Data



DIMENSIONS AND WEIGHTS:

SIZE		1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
A	in	2.20	2.20	2.52	2.95	3.35	3.86	4.17	4.80	6.38	7.01
	mm	56	56	64	75	85	98	106	122	162	178
ϕB	in	0.43	0.47	0.59	0.79	0.98	1.26	1.50	1.97	2.56	3.07
	mm	11	12	15	20	25	25	32	50	65	78
C	in	1.89	1.89	2.24	2.36	2.80	3.13	3.46	3.86	4.88	5.41
	mm	48	48	57	60	71	79.5	88	98	124	137.5
D	in	3.54	3.54	3.94	4.53	5.51	5.51	7.09	7.48	8.66	9.45
	mm	90	90	100	115	140	140	180	190	220	240
CV		6	7	10	25	35	46	80	110	310	360
Torque (in-lbf)		36	36	65	80	120	235	290	370	685	810
Weight (lbs)		0.66	0.66	0.79	1.28	2.29	3.39	4.97	8.36	15.0	25.5

Dimensions are for estimating purpose only.
Please consult factory for exact dimensions.

All valves 100% air tested underwater
at 100 psi Open and Close positions.

BILL OF MATERIALS:

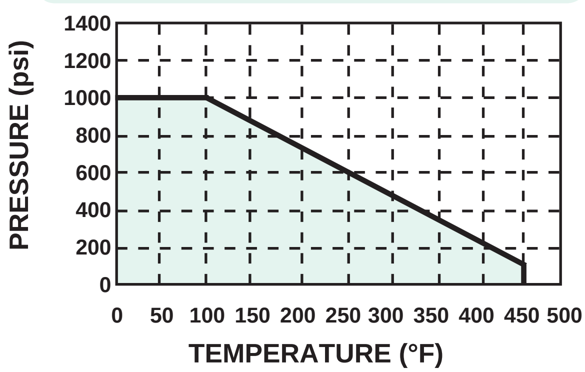
ITEM	NAME	T80SS	T80CS	QTY.
1	BODY	ASTM A351 GR. CF8M	ASTM A216 GR. WCB	1
2	END CAP	ASTM A351 GR. CF8M	ASTM A216 GR. WCB	1
3	BALL	ASTM A276 TYPE316	ASTM A276 TYPE316	1
4	SEAT	RPTFE	RPTFE	2
5	BODY SEAL	PTFE	PTFE	1
6	STEM	ASTM A276 TYPE316	ASTM A276 TYPE316	1
7	THRUST WASHER	RPTFE	RPTFE	1
8	STEM PACKING	RPTFE	RPTFE	2
9	GLAND NUT	ASTM A492 TYPE304	CARBON STEEL	1
10	HANDLE	ASTM A167 TYPE304	CARBON STEEL	1
11	LOCKING DEVICE	ASTM A167 TYPE304	CARBON STEEL	1
12	LEVER SLEEVE	VINYL PLASTISOL	VINYL PLASTISOL	1
13	SPRING WASHER	ASTM A492 TYPE304	CARBON STEEL	1
14	NUT	ASTM A492 TYPE304	CARBON STEEL	1

Conforms to:
Federal Specification WW-V-35B
Type II, Class C. Style 3

Pipe Thread in accoardance with
ANSI B2 NPT

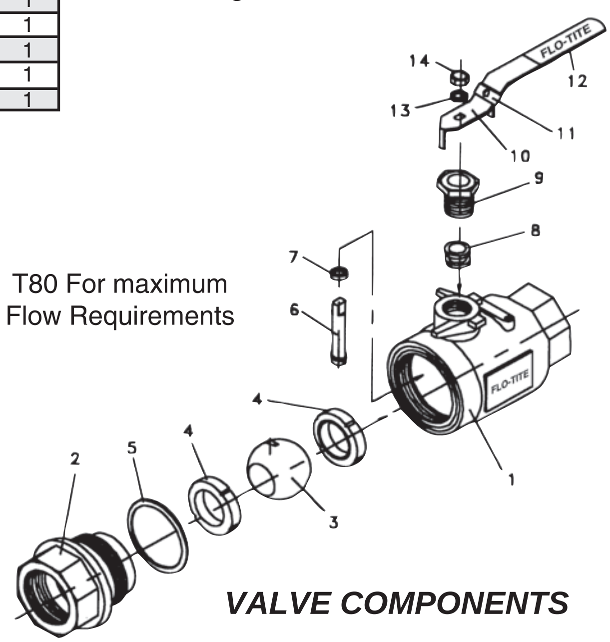
Drilled and Tapped Actuator
Mounting Pad

PRESSURE AND TEMPERATURE DATA



PRESSURE RATING: 1000 WOG

T80 For maximum
Flow Requirements



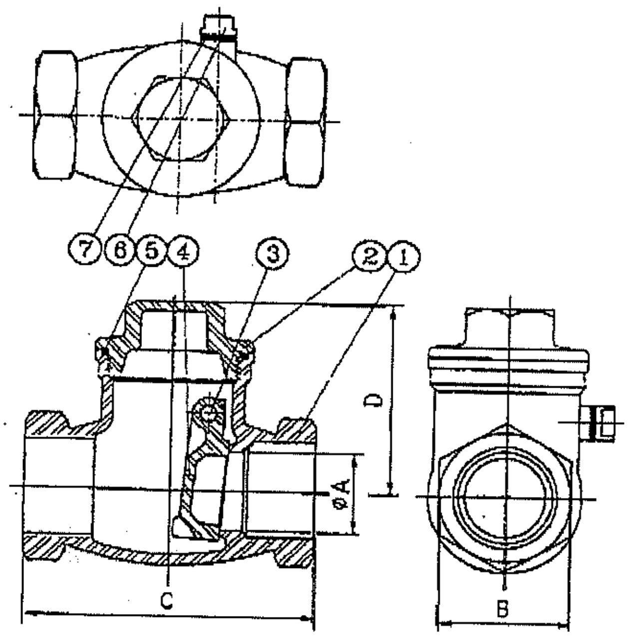
VALVE COMPONENTS

P. O. Box 1293
Lumberton, NC 28359
Website: www.flotite.com
Tel: (910) 738-8904
Fax: (910) 738-9112
E-mail: flotite@nc.rr.com

JFW VALVE®

200# Socket Weld Swing Check Valve

FIG. #SC-200SW



MATERIALS LIST

NO.	PART NAME	SPECIFICATION	QTY
[redacted]			
2	COVER	CF8M	1
[redacted]			
4	DISC	CF8M	1
[redacted]			
6	PLUG NUT	SS316	1
[redacted]			

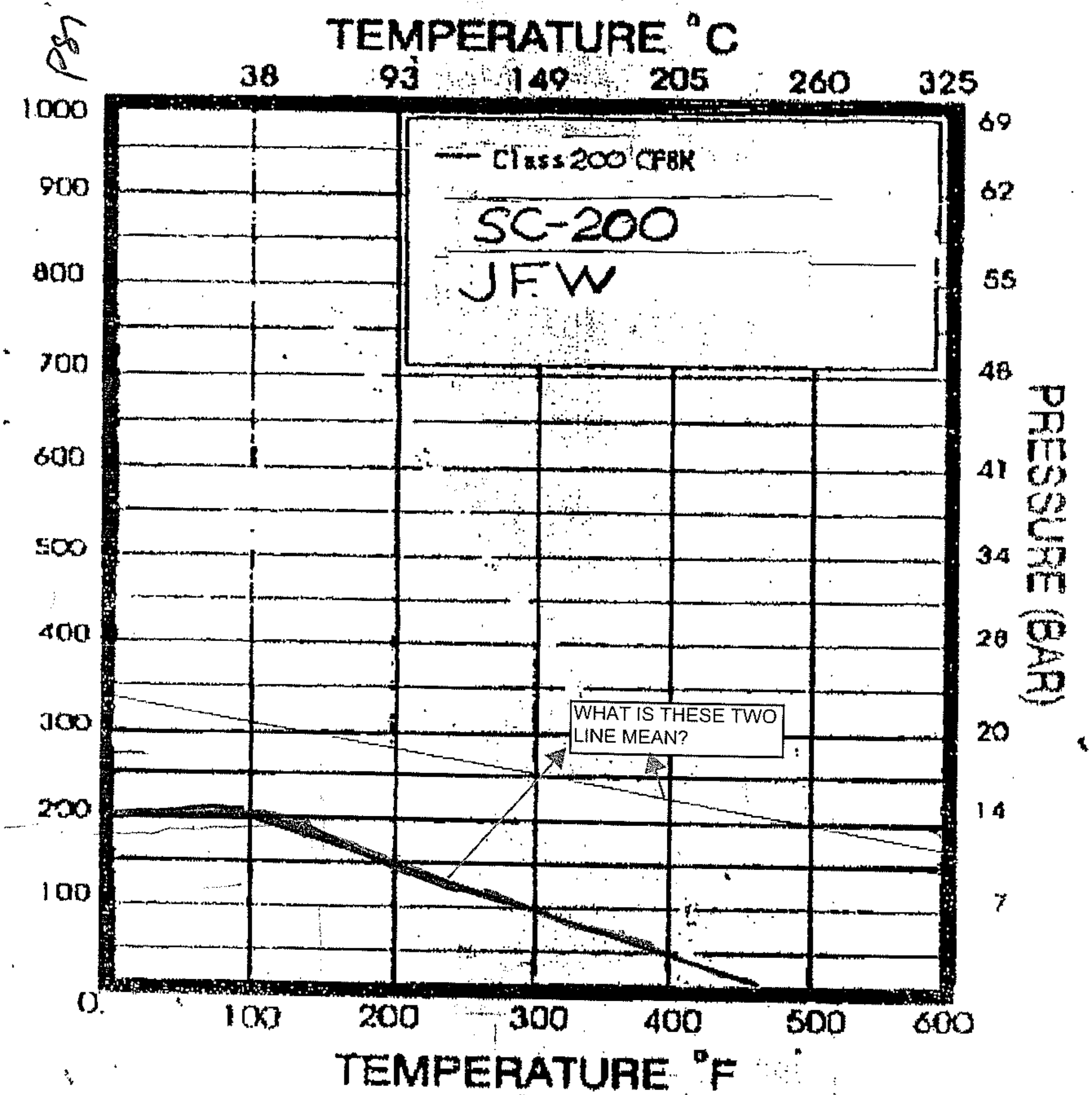
SPECIFICATIONS:

- Made by Investment Cast
- Screwed-In Cap

DIMENSIONS

SIZE	A		B		C		D		SOCKET DEPTH	UNIT WEIGHT
	MM	IN	MM	IN	MM	IN	MM	IN		
[redacted]										
3/4"	20	.79	32	1.26	80	3.15	51	2.01	.56	1.7
[redacted]										
1-1/4"	32	1.26	50	1.97	105	4.13	66	2.60	.70	3.2
[redacted]										
2"	50	1.97	70	2.76	140	5.51	80	3.15	.81	6.0

PRESSURE-TEMPERATURE RATING



FLO TITE™ valves & controls

3 PC Full Port Ball Valves

Flo-Tite's Unique...

MULTI-CHOICE SERIES

1500 WOG

I - S0 - Mount

Models:

300 - (316SS)
200 - (WCB)

SIZE 1/4" - 2 1/2"

Shown with Optional Weld-In-Place Ends

SIZE 3" & 4"
Optional 6" thru 12"

SPECIAL FEATURES

- I-SO-MOUNT TYPE AUTOMATION PAD
- WELD IN PLACE DESIGN
- SECONDARY MEDIA CONTAINMENT
- SECONDARY METAL SEAT
- LIVE-LOADED STEM ASSEMBLIES
- SWING-OUT BODY DESIGN
- SAFETY LOCKING HANDLE
- ANTI-STATIC GROUNDING DEVICE
- SUPER-TEK-SEATS, STANDARD
- CAVITY FILLER - ALL SIZES
- METAL NAME PLATES IDENTIFY ALL SOFT PARTS

END CAP SELECTION

- THREADED (NPT)
- SOCKET WELD
- BUTT WELD
- 150 LB. FLANGED
- TRI CLAMP-SANITARY END
- CAM LOCK
- TUBE END
- FLUSH BOTTOM TANK
- EXTENDED END SW
- EXTENDED END B/W

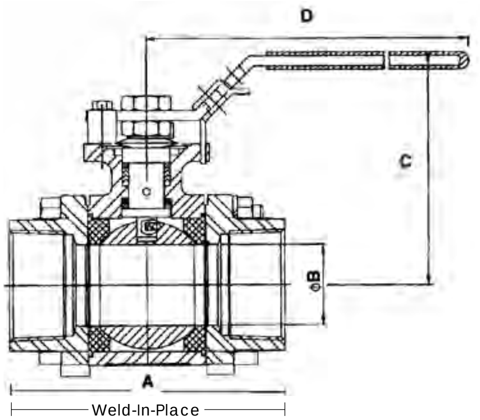
V-Port Control Valve Characterized Ball V15°, V30°, V60°, V90°

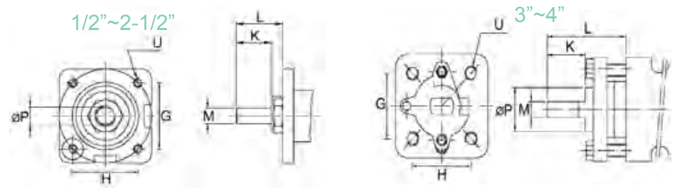
UNIQUE DESIGN

- SIZE Range 1/4" thru 4" Optional 6"~12"
- 1500 WOG/150 WSP 1/4" ~ 2", 2-1/2"~ 4", ANSI 150/300 6"~12"
- Cap Screws are used to insure precise alignment of valve center body to end caps. This high-end design feature eliminates through bolts, nuts,washer and their related problems.

Unique 3PC Design Serves As Both Valve And Union Thus Eliminating Costly And Heavy Flanges!

www.flotite.com





NOTE: Verify the Mounting dimensions before manufacturing actuator mounting hardware.

SIZE	G	H	L	K	M	ϕP	U
1/2"	1.169	1.169	0.55	0.32	0.250	0.366	#10-24UNC
3/4"	1.169	1.169	0.55	0.32	0.250	0.366	#10-24UNC
1"	1.392	1.392	0.75	0.43	0.315	0.429	1/4"-20UNC
1-1/4"	1.392	1.392	0.75	0.43	0.315	0.429	1/4"-20UNC
1-1/2"	1.949	1.949	0.91	0.55	0.374	0.618	5/16"-18UNC
2"	1.949	1.949	0.91	0.55	0.374	0.618	5/16"-18UNC
2-1/2"	2.840	2.840	1.14	0.69	0.472	0.748	5/16"-18UNC
3"	3.543	1.874	3.07	1.75	0.669	1.102	1/2 - 13 UNC
4"	3.543	1.874	3.07	1.75	0.669	1.102	1/2 - 13 UNC

BILL OF MATERIALS:

Size 1/4" thru 4" inch

NO.	PART NAME	300 SERIES STAINLESS STEEL	200 SERIES CARBON STEEL	Q'TY
1	BODY	ASTM A351 GR. CF8M - 316	ASTM A216 GR. WCB	1
2	CAP END CONNECTOR	ASTM A351 GR. CF8M **	ASTM A216 GR. WCB	2
3	BALL	ASTM A351 GR. CF8M - 316	ASTM A351 GR. CF8M - 316	1
4	SEAT *	SUPER-TEK TFM or RTFE	SUPER-TEK TFM or RTFE	2
5	STEM	ASTM A276 TYPE 316	ASTM A276 TYPE 316	1
6	BODY SEAL *	SUPER-TEK TFM OR RTFE	SUPER-TEK TFM OR RTFE	1
9	BODY BOLT	S.S 304 / ASTM A193 GR B8	S.S 304 / ASTM A193 GR B8	8/12
10	ANTI-STATIC	SS316	SS316	2
11	THRUST BEARING *	25% CARBON/TFM	25% CARBON/TFM	1
12	GUIDE SEAL *	VITON O-RING	VITON O-RING	1
14	STEM PACKING *	SUPER-TEK-TFM	SUPER-TEK-TFM	3
15	PACKING GLAND SLEEVE	SS304	SS304	1
18	BELLEVILLE WASHER	SS301	SS301	2
19	LOCK WASHER	SS304	SS304	1
23	VAVLE STOP - SET SLEEVE	SS304	SS304	1
24	VAVLE STOP - BOLT	SS304	SS304	1
25	LEVER HANDLE	SS304	SS304	1
26	THIN NUT	SS304	SS304	2
28	LEVER SLEEVE	PLASTIC	PLASTIC	1
29	LOCKING DEVICE	SS304	SS304	1

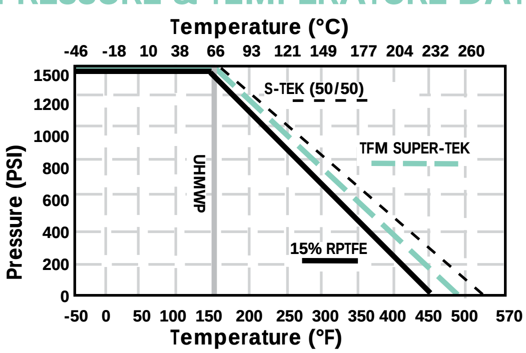
* Recommended Spare Parts (Consult factory for B8 and B7 bolting) ** Weld Ends use CF3M-316L

DIMENSIONS, TORQUES, AND WEIGHTS:

SIZE	A	WELD-IN PLACE	ØB	C	D	WEIGHT (lbs)	TORQUE (in-lbs)	CV
1/4", 3/8", 1/2	2.835	4.71	0.591	2.598	6.496	2.10	50	18
3/4"	3.346	5.02	0.787	2.913	6.496	2.43	70	42
1"	3.622	5.31	0.984	3.425	7.874	3.51	95	74
1-1/4"	4.331	5.71	1.260	3.622	7.874	5.07	190	130
1-1/2"	4.843	6.23	1.496	4.134	9.843	8.00	200	210
2"	5.591	6.76	2.000	4.528	9.843	12.00	340	380
2-1/2"	7.264	8.76	2.559	5.039	9.843	22.00	480	645
3"	7.953	9.45	2.992	6.417	15.354	32.50	780	890
4"	9.055	10.56	4.016	7.087	15.354	56.00	1600	1,620

Consult factory for sizes 6 thru 12 inch

PRESSURE & TEMPERATURE DATA



OPTIONAL SEAT MATERIALS

- UHMWP-Ultra High Molecular Weight Polyethylene
- Carbon Filled Teflon
- Bronze Filled Teflon
- Stainless Teflon
- Virgin Teflon
- Peek
- Stellite-Metal
- Super-Tek (TFM)
- Super-Tek III (Carbon/TFM)
- Cavity Fillers

* Carbon Steel Bodies are Black Phosphate Coated for Added Corrosion Resistance

* All Carbon Body Valves Have Stainless Steel Hardware

DESIGN & TECHNICAL DATA

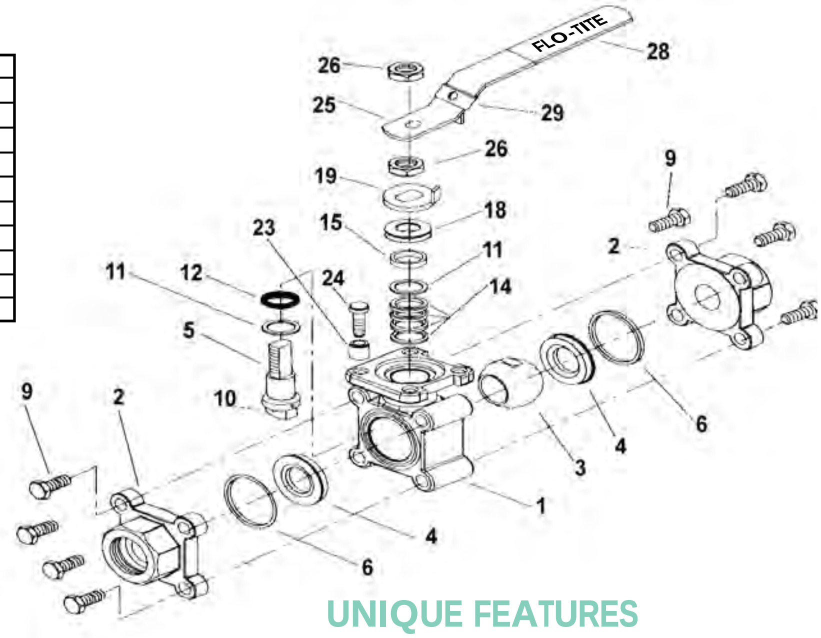
Model Numbers:

End Connections:

STAINLESS	CARBON	CONNECTIONS:
310	210	THREADED END
320	220	SOCKET WELD
330	230	BUTT WELD
340	240	150 LB. FLANGE
350	250	TRI CLAMP-SANITARY E
360	260	CAM LOCK
370	270	TUBE END
395	395	EXTENDED END B/W
390	290	GROVED END
TK300	TK200	FLUSH BOTTOM TANK

Any combination of above end connections are available C/F.
Consult Ball Valve Identification Code Guide for Full Part Number, Tech Bulletin page 188-07

Exploded View For 1/4"~2-1/2"



VALVE COMPONENTS

UNIQUE FEATURES

Ball Design Added Safety Feature:
As an added safety feature, there is a hole in the stem slot of each ball to equalize pressure between the body cavity and the flow stream when valve is in the open position.

Relief Holes in Seats Relieve Pressure Past the Upstream Seat.

Flo-Tite's safety lockable handle designed to prevent accidental movement.

The valve can also be padlocked to limit unwanted access.

SPECIFICATION STANDARDS:

- **Threaded End, ANSI B1.20.1 NPT**
- **Socket Weld, ANSI B16.11**
- **Butt Weld MSS SP72**
- **Meets WW-V35C Type II Composition: SS Style**
- **Shell Wall ANSI B16.34**
- **Flanged End Class 150 or 300**
- **Valve Body and Caps are high quality investment castings**
- **NACE MR-01.75 compliant**
- **ISO 5211 Mounting Pad**

RATINGS:

- **Pressure Rating:**
  Threaded, Socket Weld
  Butt Weld schedules 5, 10, & 40
  Size 1/4" thru 4" - 1500 WOG
  Size 6" and larger Butt Weld, Socket Weld, Threaded End - 800 WOG
- **Flanged End ANSI 150/300**
- **Steam Rating: 150 PSI WSP**
  250 PSI steam rated valves are available with Super-Tek III seats
- **Vacuum service to 20 microns**

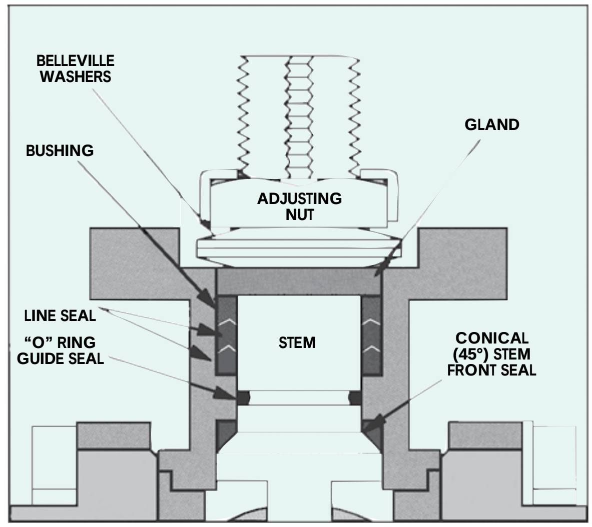
All Valves Tested to MSS SP-72 at 100 psi under Water in Open and Closed Positions

Flo-Tite's QUALITY CONTROL INCLUDES:

√√ All castings go through spectroscopic analysis
√√ Microstructure test after solution heat treating
√√ Inspection of appearance after shot blasting
√√ Size/dimension gauge test after CNC machining
√√ Final pressure leakage test at 100 PSI under water in Open and Closed positions.

FLO TITE valves & controls

Flo-Tite's Van Guard stem sealing system, designed to minimize fugitive emissions. Increases safety and provides an immediate ball valve solution to the newer EPA performance requirements, for valves meeting with a leak rate of 500ppm.



Flo-Tite's Van Guard seal, state of the art stem sealing system. Incorporating a triple set of valve stem seals. This unique system eliminates the possibility of valve stem leaks in most all media applications.

STAGE I - FRONT LINE

Stage I provides a front line defense against leakage. The blow-out proof stem shoulder has a 45 degree bell shaped slope. The bell shaped design offers more sealing surface, effectively blocking all leak paths during rotation. The wedging action of the portion of the stem is far superior to the common small flat stem shoulder design.

STAGE II - GUIDE-SEAL

The O-ring originated early in valve design and has been a proven performer in high cycle applications. Its basic function reduces the potential of machining inperfections and provide a low torque flexible seal. This center guide also helps to maintain a perfect stem alignment, by eliminating side loading stress which can cause stem leaks.

STAGE III - LIVE-SEAL

Live-Seal is considered the intellectual component and the workhorse of Flo-Tite's Van Guard stem sealling system. Working in unison with stages I and II, stage III calls upon the use of V-Ring packing sets which expands side ways as it is compressed and pressurized blocking all air pockets. The Van-Guard stem system is energized by belleville washers which continueouly adjusts packing compression to componsate for wear, pressure or temperature flactuations.

Whether your service involves volatile organic compounds, volatile hazardous chemicals, or air pollutants. Flo-Tite's ball valves are by design dependable, long lasting and fully maintainable. Flo-Tite has various valve solutions and designs that provides end users freedom of choice for the toughest requirements imposed by the industry and by international standards.

MATERIAL IDENTIFICATION

Flo-Tites marking system follows MSS SP-25-1998 guidelines. In addition to the casted body information, we have decided to add metal name plates that identify all valve soft parts. Valve users worldwide will be able to contact Flo-Tite quickly for any installation or service requirements as the company website address will be on all valves.

WELD IN-PLACE

Super-Teks high temperature seat capabilities allow weld end ball valves to be welded to the piping system without disassembly following special welding procedures. This unique advantage results in ease of installation and cost savings while insuring full integrity of the factory assembled and tested valve.

FLO TITE valves & controls
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Lumberton, NC 28359
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Fax: (910) 738-9112
E-mail: flotite@nc.rr.com

BALL VALVE IDENTIFICATION CODE AND MATERIAL SELECTION GUIDE - 3PC VALVES

MODEL	BODY MATERIAL		SECOND END CONNECTION		SEAT		STEM SEAL		BODY SEAL		OPERATOR		SIZE	
3PC 300 200 DM310 DM320 HPF40 HPF50 TK300	316SS	SS	Threaded	1	TFM	F	TFM	F	TFM	F	Lever Locking	L	1/4	8
	WCB	CS	Socket Weld	2	CTMF	Y	CTFM	Y	RTFM	X			3/8	10
	ALLOY 20	A2	Butt Weld	3	PTFE	T	RTFM	X	PTFE	T	Oval Locking	O	1/2	15
	Brass	BZ	Flanged 150	4	RPTFE	R	PTFE	T	RPTFE	R			3/4	20
			Flanged 300	5	50/50	S	RPTFE	R	50/50	S	Gear	G	1	25
			Flanged 600	6	UHMWPE	U	50/50	S	UHMWPE	U	Deadman	S	1 1/4	32
			Flanged 900	7	PEEK	P	UHMWPE	U	PEEK	P	Actuator	A	1 1/2	40
					CAVITY FILLED	C	PEEK	P	GRAPHITE	G	Bare Stem	N	2	50
					METAL	M	GRAPHITE	G	KEL-F	K	Special	X	2 1/2	65
					KEL-F	K							3	80
													4	100

SPECIAL NOTES:

- **Model Selection:** See model selection choices, consult catalog or website for more information.
- **End Connection:** Valve model number indicates end connection type. Second End Connection notation can be used in conjunction with valve model number to indicate a combination such as: NPT x Socket Weld.
- **For V-Modulating Control V-Ball** add a 'V' before the valve model number.
- **Ball:** All ball material is supplied standard as 316SS. If different material is required please specify as a special feature.
- **Special Features** are noted at the end of the identification number, please see special feature codes.
- **Ordering Information:** When placing an order or requesting a quotation, please provide as many details on the application as possible such as: media type, temperature, pressure, pipe size, etc.

Ordering Example By Part Number - 3PC Valves:

* Donates Special Feature if Required.

3PC	316SS	NPT x SW	TFM	GRAPHITE	TFM	LEVER	2"	MEDIA CONTAINMENT
MODEL	BODY MATERIAL	2nd END CONNECTION	SEAT	STEM SEAL	BODY SEAL	OPERATOR	SIZE	*SPECIAL FEATURE
310	SS	2	F	G	F	L	50	H3

Tri-Star Series 3pc 1500 WOG Model Types - Full Port:

STAINLESS	CARBON	END CONNECTION
510	410	NPT Threaded
520	420	Socket Weld

Tri-Pro Series 3pc Fire Safe 2250/3000 WOG Model Types - Full Port / Standard Port:

Full Port	STAINLESS	Standard Port	Full Port	CARBON	Standard Port	END CONNECTION
HPF51		HPS51	HPF41		HPS41	NPT Threaded
HPF52		HPS52	HPF42		HPS42	Socket Weld
HPF53		HPS53	HPF43		HPS43	Butt Weld
HPF56		N / A	HPF46		N / A	Flanged - 600

Multi-Choice Series 3pc Full Port 1500 WOG Model Types - Full Port:

STAINLESS	CARBON	END CONNECTION
310	210	NPT Threaded
320	220	Socket Weld
330	230	Butt Weld
340	240	Flanged - 150
350	-	Tri Clamp
370	-	Tube End
TK300	TK200	Tank Pad

HAYWARD®

TB Series True Union Ball Valves

1/4" TO 2" PVC AND CPVC

Sizes 1/4" – 2"

KEY FEATURES

- PVC and CPVC
- Full Port Design
- Reversible PTFE Seats
- Double O-Ring Stem Seals
- Easily Actuated
- NSF / ANSI 61 Listed

OPTIONS

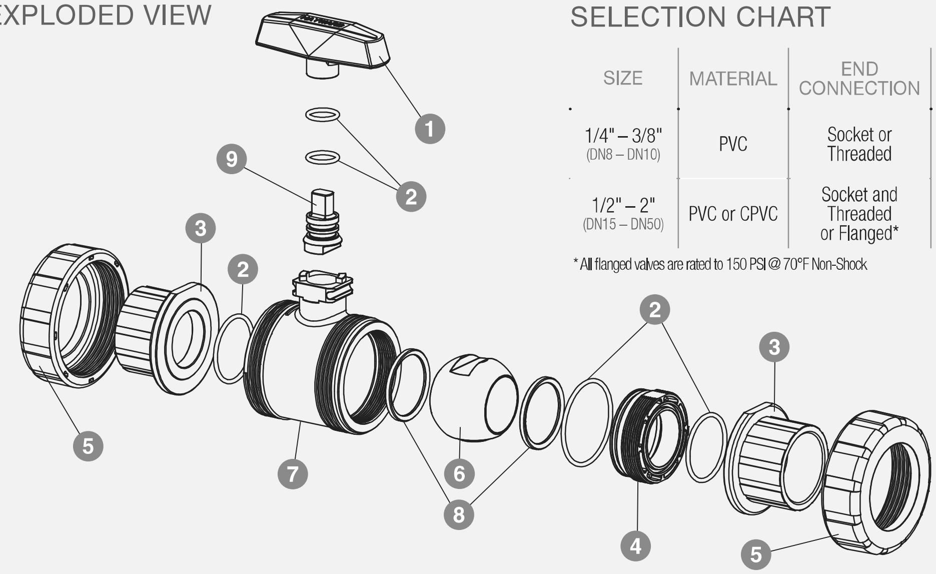
- Lockouts Available
- 2" Square Operating Nut
- Stem Extensions
- Pneumatic and Electric Actuated
- Spring Return Handle

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

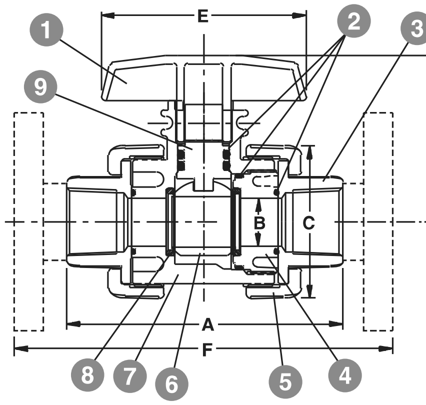
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/4" – 3/8" (DN8 – DN10)	PVC	Socket or Threaded	FPM or EPDM	250 PSI @ 70°F Non-Shock
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded or Flanged*		

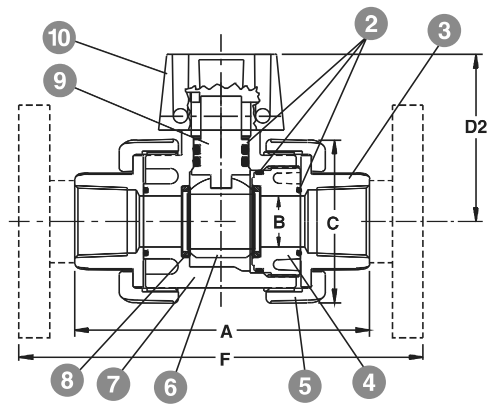
* All flanged valves are rated to 150 PSI @ 70°F Non-Shock

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Handle
2. O-Ring Seals
3. End Connector
4. Seal Retainer
5. Union Nut
6. Ball
7. Body
8. PTFE Seat
9. Stem
10. Actuator Mounting Pad





DIMENSIONS – INCHES / MILLIMETERS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D1 in / mm	D2 in / mm	E in / mm	F in / mm	WEIGHT lbs / kg SOC / THD	FLANGED
1/4 / 8	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
3/8 / 10	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	N/A	.75 / .34	N/A
1/2 / 15*	4.77 / 121	.50 / 13	2.25 / 57	2.81 / 71	2.63 / 67	3.50 / 89	6.75 / 171	.75 / .34	1.00 / .45
3/4 / 20*	4.85 / 123	.75 / 19	2.63 / 67	3.02 / 77	2.81 / 71	3.50 / 89	7.13 / 181	.75 / .34	1.00 / .45
1 / 25*	5.44 / 138	.93 / 24	3.00 / 76	3.26 / 83	3.05 / 77	4.00 / 102	8.09 / 205	1.15 / .52	2.15 / .98
1-1/4 / 32*	6.30 / 160	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.19 / 233	2.15 / .98	3.50 / 1.59
1-1/2 / 40*	6.85 / 174	1.50 / 38	4.00 / 102	3.92 / 100	3.48 / 88	5.00 / 127	9.88 / 251	2.15 / .98	3.75 / 1.70
2 / 50*	8.00 / 203	1.94 / 49	4.75 / 121	4.43 / 113	4.00 / 102	5.00 / 127	11.4 / 290	3.80 / 1.72	6.30 / 2.86

Dimensions are subject to change without notice – consult factory for installation information
* Metric End Connections Available In: BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Cv VALUES

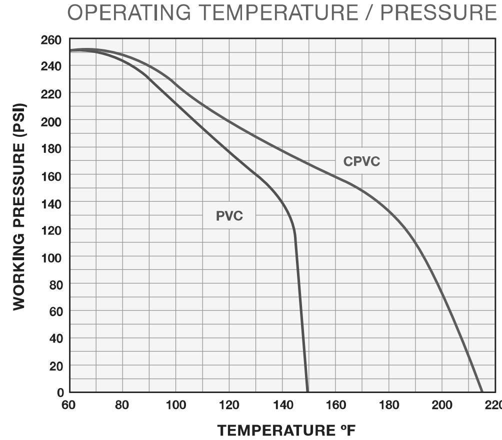
SIZE in / DN	Cv VALUES GPM	SIZE in / DN	Cv VALUES GPM
1/4 / 8	1.0	1 / 25	29.0
3/8 / 10	2.8	1-1/4 / 32	75.0
1/2 / 15	8.0	1-1/2 / 40	90.0
3/4 / 20	16.0	2 / 50	150.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

OPERATING TEMPERATURE / PRESSURE



Contact Hayward Flow Control with questions: 1-888-429-4635 • Fax: 1-888-778-8410 • One Hayward Industrial Drive • Clemmons, NC 27012 • USA
Visit us at: www.haywardflowcontrol.com • E-mail: hflow@haywardnet.com

TC Series True Union Ball Check Valves

1/4″ to 6″ PVC, Corzan® CPVC, PPL

Backflow Prevention
Hayward True Union Ball Check Valves prevent reversal of flow in piping systems. They are ideal where backflow could potentially cause damage to pumps, filters, or process equipment.

Automatic Operation
Hayward True Union Ball Check Valves operate without the need for any adjustments or settings. Line pressure moves the solid plastic ball off the elastomer seat, opening the valve. When the inlet flow stops, back pressure moves the ball back onto the seat – stopping the flow. Additionally, this valve features a unique square-cut elastomer seat to seal at low back pressures.

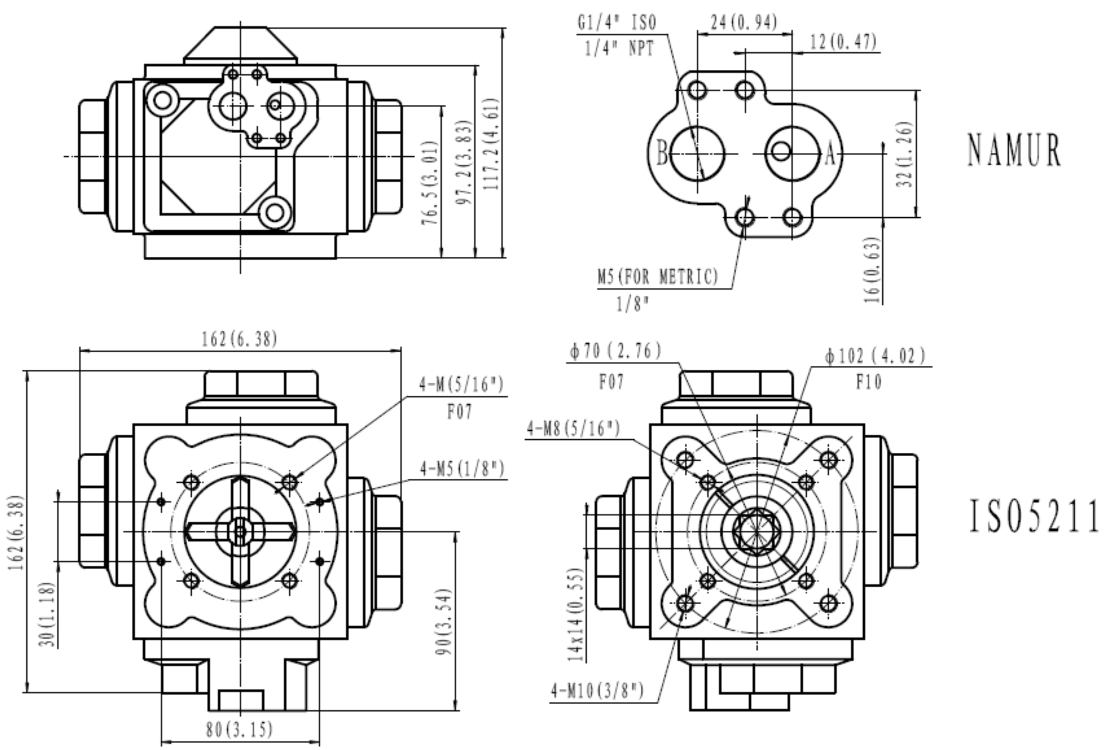
True Union Design
Sizes 1/2″ to 6″ feature a true union design. This allows for easy removal from a piping system without breaking down piping connections. Just unscrew the two assembly nuts and lift the valve body out of the line. A Trim Check design is used for the 1/4″ and 3/8″ sizes. While not true union, the valves are fully repairable, unlike some other smaller check valves.

No Corrosion Failures
Because of their all-plastic construction, these valves will never jam or stick as a result of rust or corrosion. Also they will not contaminate sensitive fluids that come into contact with them.

Features
- Full Port Design to 4″
- True Union Design
- Easy Maintenance
- FPM or EPDM Seals
- Unique Square Cut Seat
- Works in Any Position Except Downflow

Options
- Foot Valve Screens

Corzan® is a registered trademark of Noveon, Inc.



MODEL NO.

ALF-25

PRODUCT LINE

ALPHA ALF Series Komp 4 Actuator

TECHNICAL DATA

Operating Temperature	Standard:-20℃-80℃ On requires: -20℃-120℃ -40℃-80℃
Connection Interface	NAMUR, ISO 5211
Travel adjustment	±5° at both open and closed directions(90°)
Approval	CE 0575 Ex II 2 GD EEX c IIC T6

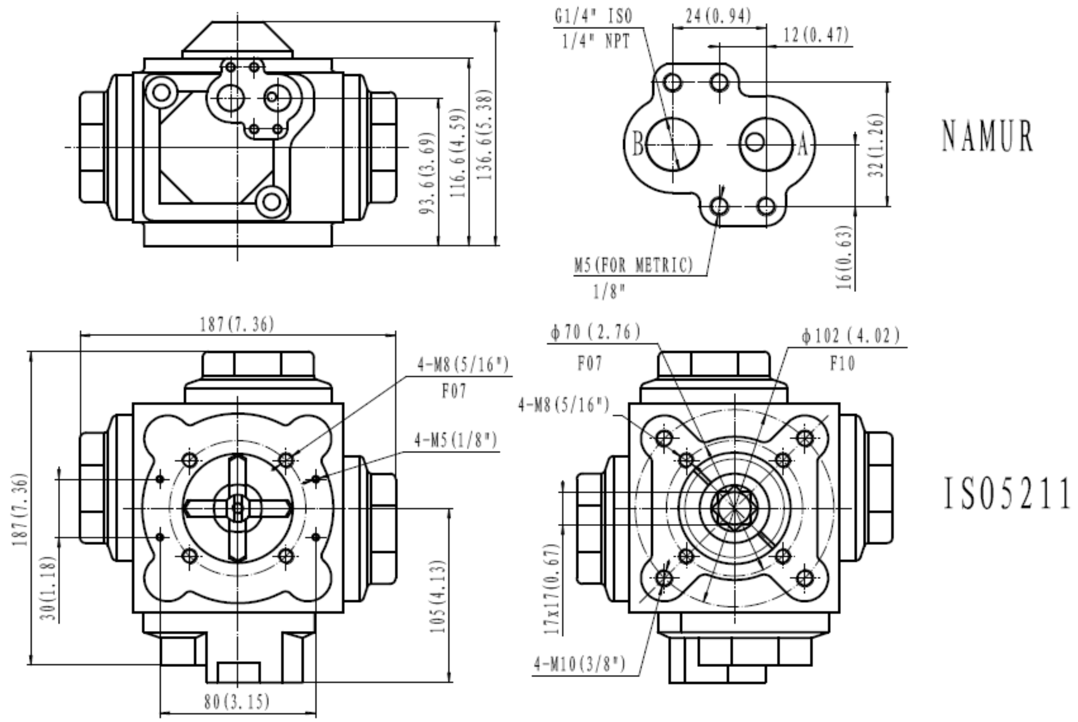
Output Torque (DA)

Bar	3	4	5	5.5	6	7	8
Nm	39	52	65	72	79	92	105

Output Torque (SR)

Bar / Nm	3		4		5		5.5		6		7		8		Spring Stroke	
Code	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
S2M4	25	15	38	27	51	40	58	47	65	53	78	66	90	78	23	13
S4M4	23	11	36	23	49	36	55	42	62	49	75	62	88	74	28	16
S4M2L2			33	19	46	32	53	39	60	45	73	58	86	70	32	18
S4L4					43	27	50	34	57	41	70	53	83	66	36	21
S4M4L2					41	22	47	29	54	36	67	48	80	61	42	24
M4L4					38	18	45	24	52	31	64	44	77	56	47	27
S2M4L4							43	19	50	25	63	38	75	50	52	29
S4M4L4									47	21	60	34	73	46	57	31

ALPHA®
www.a-torque.com
Wuxi St.hans Air Controls Export / Import Co.,Ltd.
No.48 Xihong Road, Meicun Industrial Park, New Area Wuxi, Jiangsu, 214112, China
Tel: 86-0510-85222125 Fax: 86-0510-85223552 www .a-torque.com
ALLIED®
www.allied-flow.com



MODEL NO.	
ALF-30	
PRODUCT LINE	
ALPHA ALF Series Komp 4 Actuator	
TECHNICAL DATA	
Operating Temperature	Standard:-20℃-80℃ On requires: -20℃-120℃ -40℃-80℃
Connection Interface	NAMUR, ISO 5211
Travel adjustment	±5° at both open and closed directions(90°)
Approval	CE 0575 Ex II 2 GD EEX c IIC T6

Output Torque (DA)

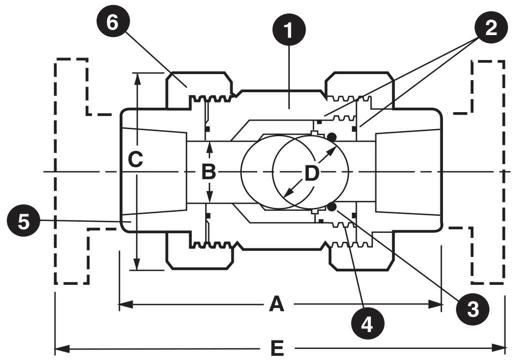
Bar	3	4	5	5.5	6	7	8
Nm	62	84	107	119	130	153	176

Output Torque (SR)

Bar / Nm	3		4		5		5.5		6		7		8		Spring Stroke	
Spring Code	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
S2M4	40	26	62	47	84	70	96	81	107	92	130	114	152	136	35	21
S4M4	36	19	57	40	80	62	91	73	102	84	125	107	148	129	42	26
S4M2L2			52	30	75	52	86	63	98	74	120	96	143	118	53	31
S4L4			48	18	70	43	81	54	93	65	115	87	138	109	62	36
S4M4L2					66	36	77	47	89	58	111	80	134	103	69	40
M4L4					64	25	73	39	85	50	107	72	130	94	78	44
S2M4L4									80	40	102	62	125	85	88	49
S4M4L4									75	33	98	55	120	77	96	54

Technical Information

True Check with foot valve screen installed



Parts List True Union Ball Check Valves

1. Body
2. O-Ring Seals
3. Square Cut O-Ring Seat
4. Seal Retainer
5. End Connector
6. Union Nut

Dimensions - Inches / Millimeters

Size	A	B	C	D	E	F	G	Weight - (lb / kg) Socket/ Threaded	Flanged
1/4″	3.06 / 78	0.31 / 8	1.38 / 35	0.50 / 13	N/A	N/A	N/A	0.13 / .06	N/A
3/8″	3.06 / 78	0.31 / 8	1.38 / 35	0.50 / 13	N/A	N/A	N/A	0.13 / .06	N/A
1/2″ / 20*	4.63 / 118	0.50 / 13	2.25 / 57	0.75 / 19	6.75 / 171	4.88 / 124	2.32 / 59	0.75 / .34	1.00 / .45
3/4″ / 25*	4.75 / 121	0.75 / 19	2.63 / 67	1.0 / 25	7.13 / 181	5.00 / 127	2.60 / 66	0.75 / .34	1.38 / .63
1″ / 32*	5.25 / 133	1.00 / 25	3.00 / 76	1.25 / 32	7.75 / 197	5.88 / 14	2.88 / 73	1.25 / .57	2.13 / .97
1-1/4″ / 40*	6.30 / 160	1.25 / 32	4.00 / 102	1.75 / 44	9.19 / 233	6.94 / 17	3.75 / 95	2.00 / .90	3.75 / 1.70
1-1/2″ / 50*	6.75 / 171	1.50 / 38	4.00 / 102	1.75 / 44	9.75 / 248	7.06 / 17	3.75 / 95	2.00 / .90	3.75 / 1.70
2″ / 63*	8.00 / 203	1.94 / 49	4.75 / 121	2.25 / 57	11.25 / 286	8.56 / 217	4.50 / 114	3.75 / 1.70	5.75 / 2.60
2-1/2″	10.68 / 271	2.88 / 73	6.56 / 167	3.25 / 83	14.38 / 365	11.25 / 286	2.50 / 64	10.00 / 4.54	14.00 / 6.36
3″ / 90*	10.56 / 268	2.88 / 73	6.56 / 167	3.25 / 83	14.38 / 365	11.25 / 286	2.50 / 64	10.00 / 4.54	14.00 / 6.36
4″ / 110*	12.94 / 329	4.00 / 102	8.56 / 217	4.25 / 108	17.00 / 432	14.63 / 372	4.25 / 108	17.00 / 7.72	25.00 / 11.36
6″	N/A	4.00 / 102	N/A	4.25 / 108	19.19 / 487	N/A	N/A	N/A	30.20 / 13.73

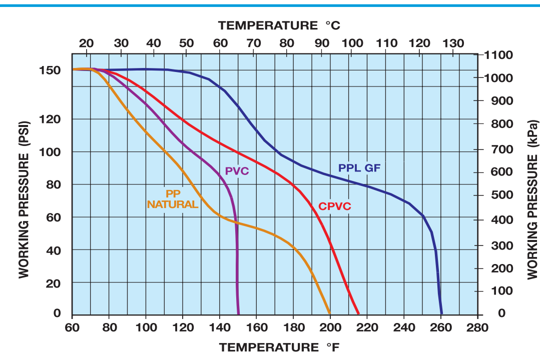
* **Metric End Connections Available in:** BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Selection Chart

Size	Material	End. Conn.	Seals	Pressure Rating
1/4″ - 3/8″*	PVC	Socket or Threaded	FPM	150 PSI @70°F Non-Shock
1/2″ - 4″	PVC or CPVC	Socket, Threaded, or Flanged	FPM or EPDM	
1/2″ - 2″	NAT. PPL***	Threaded	FPM	
6″**	PVC or CPVC	Flanged		

*Trim Check Design
** 4″ Valve Venturied to 6″
*** 2″ Rated at 100 PSI

Operating Temperature/Pressure



Pressure Loss Calculation Formula

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

Cv Factors

Size	Factor	Size	Factor
1/4″	1.0	1-1/2″	45
3/8″	3.0	2″	130
1/2″	4.8	2-1/2″	170
3/4″	7.7	3″	250
1″	11	4″	400
1-1/4″	25	6″	340

Hy-Lok 110 Series Ball Valves

for use with 1/4" thru 2" Tube and Piping Systems

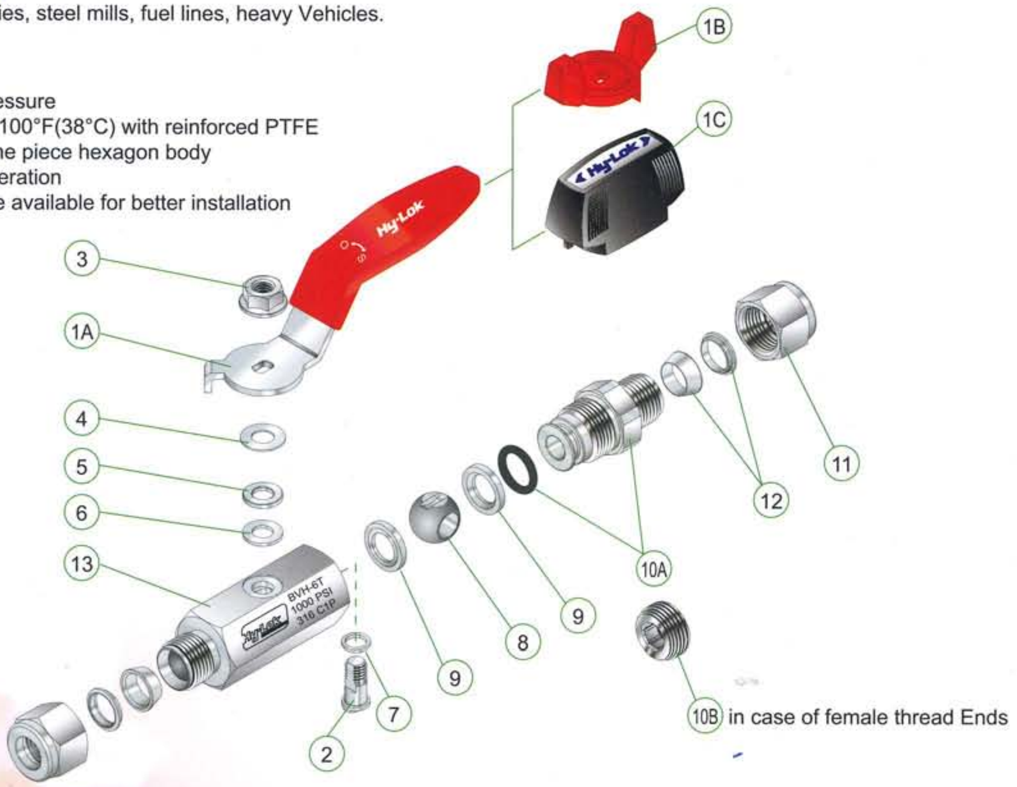
Catalog No. H-110BV
Mar. 2007

Application

Chemical plants, refineries, steel mills, fuel lines, heavy Vehicles.

Features

Maximum Operating Pressure
of 1000psig(69barg) @ 100°F(38°C) with reinforced PTFE
Compact Design with one piece hexagon body
Low Torque for easy operation
Butterfly & Nylon Handle available for better installation
in a restricted space

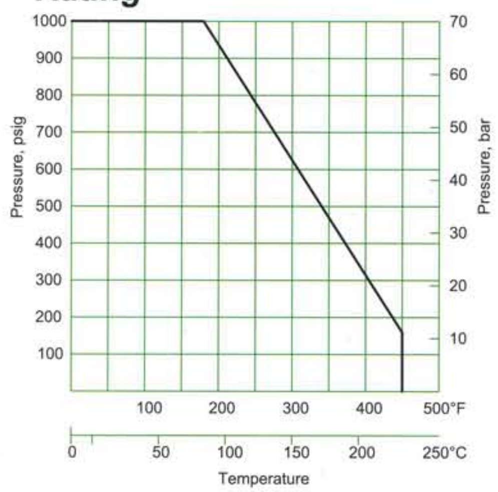


Material of Constructions

Item	Description	Grade / ASTM Specification	
		SS316	Brass
1A	Handle	SS316 Lever with Coated(Red Color)	
1B		Zinc with Nickel Plated(Red & Blue Color available)	
1C		Dielectric Nylon(Black Color)	
2	Stem	SS316 / A479	
3	Lock Nut	SS316	
4	Gland Washer	SS316	
5	Gland	SS316	
6	Outer Packing	Reinforced PTFE	
7	Inner Packing	Reinforced PTFE	
8	Ball	SS316 / A479	
9	Seat	Reinforced PTFE	
10A	End Connector	SS316 / A479	Brass / B16
		with O-Ring*	
10B	Insert	SS316 / A479	
11	Nut	SS316 / A479	Brass / B16
12	Ferrule	SS316 / A479	Brass / B16
13	Body	SS316 / A479	Brass / B16

"*"O-Ring of NBR standard, FPM(e.g Viton)on request.

Pressure-Temperature Rating



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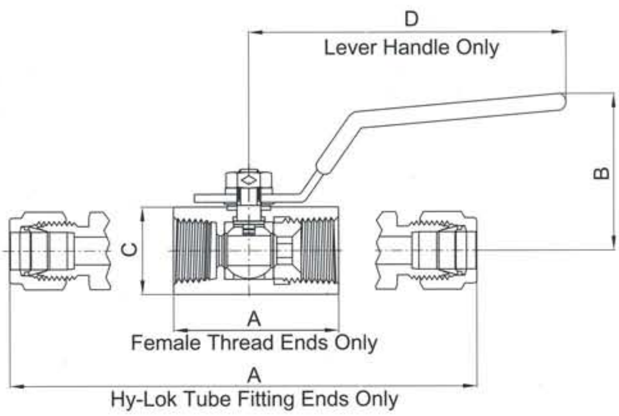


Table of Dimensions

Basic Part NO.	Orifice	Cv	End Connections	Dimensions				Weight (kg)
			Both Ends	A	B	C (Hex)	D	
BVH-6M	5.0	0.84	6mm Hy-Lok	79.5	31	17.0	60.0	0.13
BVH-4T			1/4" Hy-Lok	79.5				0.13
BVF-4N			1/4" Female NPT	40.0				0.07
BVH-10M	7.5	4.20	10mm Hy-Lok	90.0	40	20.6	80.0	0.22
BVH-6T			3/8" Hy-Lok	90.0				0.22
BVF-6N			3/8" Female NPT	45.0				0.13
BVH-12M	9.0	6.50	12mm Hy-Lok	99.0	42	27.0	80.0	0.34
BVH-8T			1/2" Hy-Lok	99.0				0.34
BVF-8N			1/2" Female NPT	54.5				0.21
BVH-16M	12.5	8.00	16mm Hy-Lok	109.0	51	32.0	100.0	0.49
BVH-10T			5/8" Hy-Lok	109.0				0.49
BVF-12N			3/4" Female NPT	61.0				0.33
BVH-12T			3/4" Hy-Lok	110.0				0.57
BVH-16T	16.0	25.00	1" Hy-Lok	134.0	55	38.0	100.0	0.85
BVF-16N			1" Female NPT	76.0				0.60
BVF-20N	21.0	-	1 1/4" Female NPT	89.0	65	50.0	151.0	0.90
BVF-24N	24.0	-	1 1/2" Female NPT	95.0	68	55.0	148.5	1.10
BVF-32N	32.0	-	2" Female NPT	110.0	73	70.0	144.0	2.00

All dimensions are in millimeters. Dimensions shown with Hy-Lok nuts in finger-tight position, where applicable.

Ordering Information

BV **H** **6T** **B** **S316**

Valve Type Designator

Size Designator

Body Material Designator
S316 - 316 Stainless Steel
BRAS - Brass

End Connection Designator
H : Hy-Lok Tube Fitting
F : Female Pipe Thread

Handle Designator
Nil : Lever
B : Butterfly Handle
N : Nylon Handle

NPT (ISO / BSP)

Thread(in.)	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Designator	4N(R)	6N(R)	8N(R)	12N(R)	16N(R)	20N(R)	24N(R)	32N(R)

Tube

Fractional Tube	O.D(in.)	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
	Designator	4T	5T	6T	8T	10T	12T	14T	16T
Metric Tube	O.D(mm)	6	8	10	12	15	16	22	25
	Designator	6M	8M	10M	12M	15M	16M	22M	25M

Note "*" : No designator is required for Lever Handle e.g. BVH-6T - S316

SAFETY in VALVE SELECTION

Proper installation, material compatibility, operation and maintenance of these valves are the responsibility of the user. The total system design must be taken into consideration to ensure optimal performance and safety.

■ QUALITY SYSTEM CERTIFICATES

ISO 9001
CERTIFICATE NO.GQC 212

ASME SECT Ⅲ (MO)
CERTIFICATE NO. QSC 584

■ TYPE APPROVALS (for Hy-Lok Tube Fittings)

American Bureau Shipping
CERTIFICATE NO.00-BK50288-X

Lloyd's Register
CERTIFICATE NO.01/10075

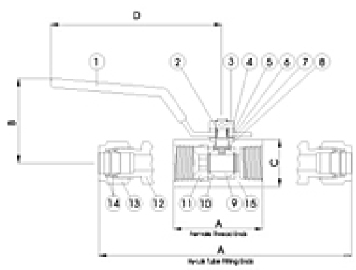
GERMANISCHER LLOYD
CERTIFICATE NO.57798-91 HH

DET NORSKE VERITAS
CERTIFICATE NO.P-9100

Hy-Lok USA
7883 Airway Park
Mobile, AL 36608
Phone: 251-633-3767
Fax: 251-633-7359

110 Series: Ball Valves

Applications
• Chemical plants, refineries, steel mills. Fuel Lines, Heavy Vehicles
Features
• Maximum Operating Pressure
of 1000 psig(69 bar) at 100ºF(38ºC) with reinforced PTFE
•Compact design with one piece hexagon body
•Low torque for easy operation
•Butterfly handle is available as an option



Results 1 - 15 of 15

Part Number	Dimension A	Dimension B	Dimension C (Hex)	Dimension D	Inlet End Connection	Orifice	Outlet End Connection	List Price
BVH-6M	79.5 mm	31 mm	17 mm	60 mm	6mm Hy-Lok	5.0	6mm Hy-Lok	QUOTE
BVH-4T	79.5 mm	31 mm	17 mm	60 mm	1/4" Hy-Lok	5.0	1/4" Hy-Lok	QUOTE
BVF-4N	40 mm	31 mm	17 mm	60 mm	1/4" Female NPT	5.0	1/4" Female NPT	QUOTE
BVH-10M	90 mm	40 mm	20.6 mm	80 mm	10mm Hy-Lok	7.5	10mm Hy-Lok	QUOTE
BVH-6T	90 mm	40 mm	20.6 mm	80 mm	3/8" Hy-Lok	7.5	3/8" Hy-Lok	QUOTE
BVF-6N	45 mm	40 mm	20.6 mm	80 mm	3/8" Female NPT	7.5	3/8" Female NPT	QUOTE
BVH-12M	99 mm	42 mm	27 mm	80 mm	12mm Hy-Lok	9.0	12mm Hy-Lok	QUOTE
BVH-8T	99 mm	42 mm	27 mm	80 mm	1/2" Hy-Lok	9.0	1/2" Hy-Lok	QUOTE
BVF-8N	54.5 mm	42 mm	27 mm	80 mm	1/2" Female NPT	9.0	1/2" Female NPT	QUOTE
BVH-16M	109 mm	51 mm	32 mm	100 mm	16mm Hy-Lok	12.5	16mm Hy-Lok	QUOTE
BVH-10T	109 mm	51 mm	32 mm	100 mm	5/8" Hy-Lok	12.5	5/8" Hy-Lok	QUOTE
BVF -12N	61 mm	51 mm	32 mm	100 mm	3/4" Female NPT	12.5	3/4" Female NPT	QUOTE
BVH-12T	110 mm	51 mm	32 mm	100 mm	3/4" Hy-Lok	16.0	3/4" Hy-Lok	QUOTE
BVH-16T	134 mm	55 mm	38 mm	100 mm	1" Hy-lok	16.0	1" Hy-lok	QUOTE
BVF-16N	75 mm	55 mm	38 mm	100 mm	1" Female NPT	16.0	1" Female NPT	QUOTE

Results 1 - 15 of 15

SDL Project - Pump Totals

		Pump Information				Motor Information			
Qty	Location	Brand	Pump Model #	Capacity	Connect	HP	Motor	Motor Brand	Frame
1	VSEP Feed Pumps	Grundfos	CRN-20-10 APGVHQQV	19.8 m3/hr @ 500 psi	2" vic	25 hp	440V 3ph TEFC	Baldor	256 TC
1	VSEP Feed Pumps	Grundfos	CRN-20-9SF APGVHQQV	19.8 m3/hr @ 500 psi	2" vic	25 hp	440V 3ph TEFC	Baldor	256 TC
1	Spiral Feed Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	Spiral Feed Pump	Grundfos	CRN-15-11SF APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	CIP Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	2" vic	20 hp	440V 3ph TEFC	Baldor	256 TC
1	Metering Pumps	Chemtech	X100-XC-AAAAXXX	22.5 gpd @ 60psi	3/8 MNPT	-	220V 1ph TEFC	-	-
2	Metering Pumps	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	1/2" npt	3/4 hp	220V 1ph TEFC	Baldor	56C

Note: Does not include off-skid equipment.

SDL Project - Pump's List									
VSEP Feed Pump Skid - Stage 1									
Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-100	Pump 100	Grundfos	CRN-20-10 APGVHQQV	19.8 m3/hr @ 500 psi	25 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
P-101	Pump 101	Grundfos	CRN-20-9SF APGVHQQV	19.8 m3/hr @ 500 psi	25 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
CIP Skid									
Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-190	CIP Pump	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
Spiral RO Skid - Stage2									
Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-200	Pump 200	Grundfos	CRN-15-10 APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
P-201	Pump 201	Grundfos	CRN-15-11SF APGVHQQV	14.85 m3/hr @ 500 psi	20 hp	440V 3ph TEFC	316L SS, Viton	2" vic	-15º to 100ºC
Chemical Tote									
Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
CP-404	NLR 404 Tote	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	3/4 hp	220V 1ph 60 Hz	316L SS, Teflon	1/2" npt	-15º to 100ºC
CP-505	NLR 505 Tote	Bran+Luebbe	MD 200S 19111 000	1 gpm @ 30 psi	3/4 hp	220V 1ph 60 Hz	316L SS, Teflon	1/2" npt	-15º to 100ºC
CP-560	NLR 560 Drum	Chemtech	X100-XC-AAAAXXX	100 gpd @ 60psi	-	220V 1ph 60 Hz	PVC, EPDM	3/8 MNPT	-15º to 100ºC
Off-Skid Pumps (provided by others)									
Tag #	Location	Brand	Model #	Capacity	HP	Motor	Wetted Materials	Connect	Temp
P-110	Fill VSEP Batch Feed Tank, T-110	Unknown	Unknown	45 m3/hr @ 30 psi	Unknown	Unknown	Unknown	Unknown	Unknown
P-120	VSEP Reject Tank, T-120 Outlet	Unknown	Unknown	10 m3/hr @ 150 psi	Unknown	Unknown	Unknown	Unknown	Unknown
P-300	VSEP Permeate Tank, T-130 Outlet	Unknown	Unknown	3 m3/hr @ 30 psi	Unknown	Unknown	Unknown	Unknown	Unknown

Company name:	-
Created by:	-
Phone:	-
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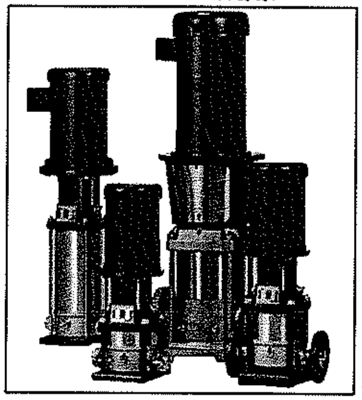
Date:	-

Position	*Qty.*	*Description*	*Single Price*
	1	CRN 15-10 A-P-G-V HQQV	On request



Note! Product picture may differ from actual product

Product No.: 96523510
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:

- Impellers, intermediate chambers and outer sleeve are made of
Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr..
- Pump head cover and base are made of
Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr..
- The shaft seal has assembly length according to EN 12756.
- Power transmission is via cast iron split coupling.
- Pipework connection is via PJE (Victaulic) flanges/couplings.

The motor is a 3-phase AC motor.

Liquid:

Liquid temperature range:	253 .. 363 K

Technical:

Speed for pump data:	3497 rpm
Rated flow:	20.5 m^3/h
Rated head:	162 m
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Installation:

Maximum ambient temperature:	313 K
Max pressure at stated temp:	25 / 90 bar / °C

Position	Qty.	Description		Single Price
			25 / -20 bar / °C	
		Flange standard:	PJE (Victaulic)	
		Pipe connection:	2 3/8"	
		Flange size for motor:	254TC	
		Electrical data:		
		Motor type:	254TC	
		Number of poles:	2	
		Rated power - P2:	15 kW	
		Power (P2) required by pump:	15 kW	
		Mains frequency:	60 Hz	
		Rated voltage:	3 x 230 / 460 V	
		Rated speed:	3525 rpm	
		Enclosure class (IEC 34-5):	IP23	
		Insulation class (IEC 85):	B	
		Others:		
		Net weight:	128 kg	
		Shipping volume:	0.34 m³	

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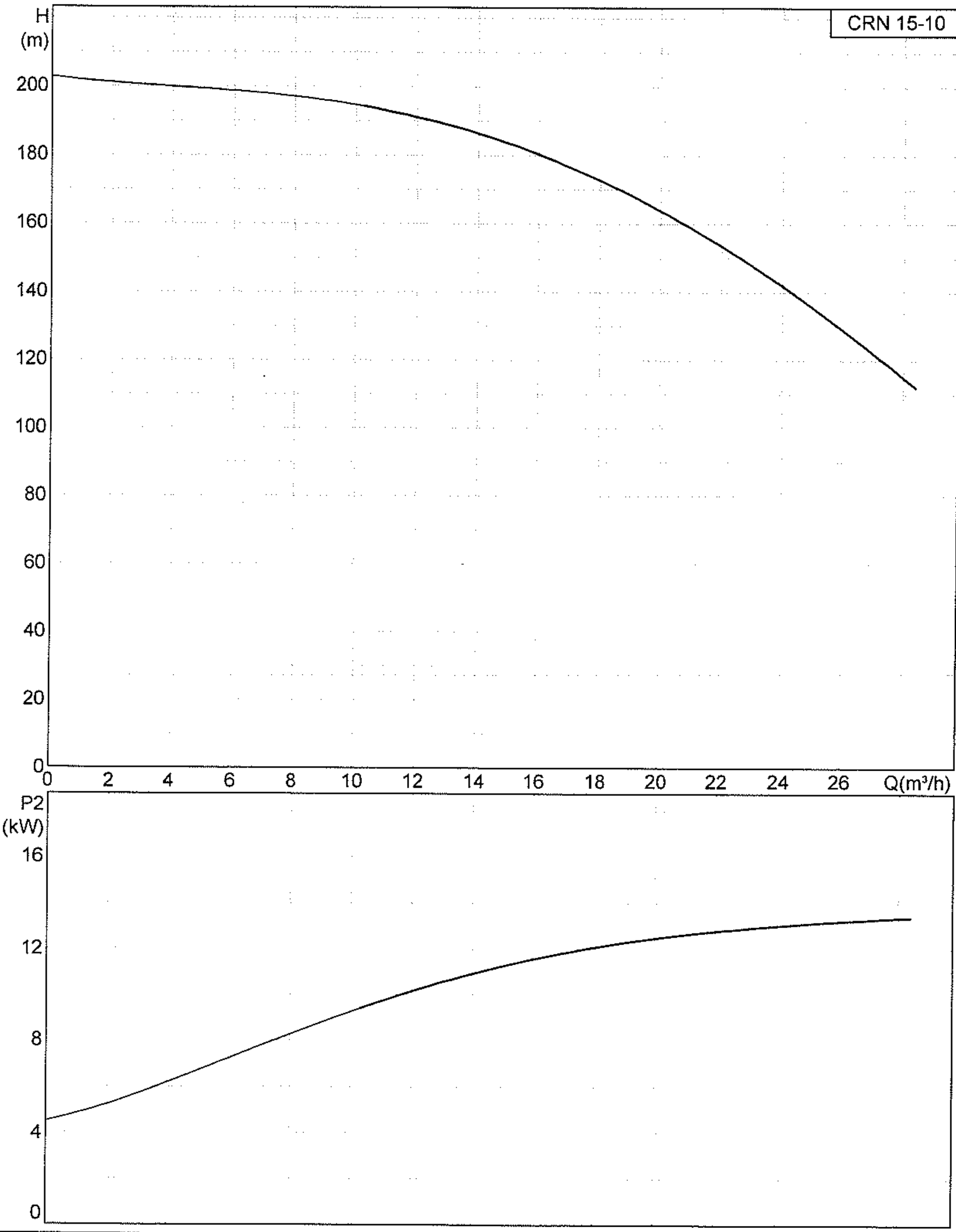
Date: -

96523510 CRN 15-10



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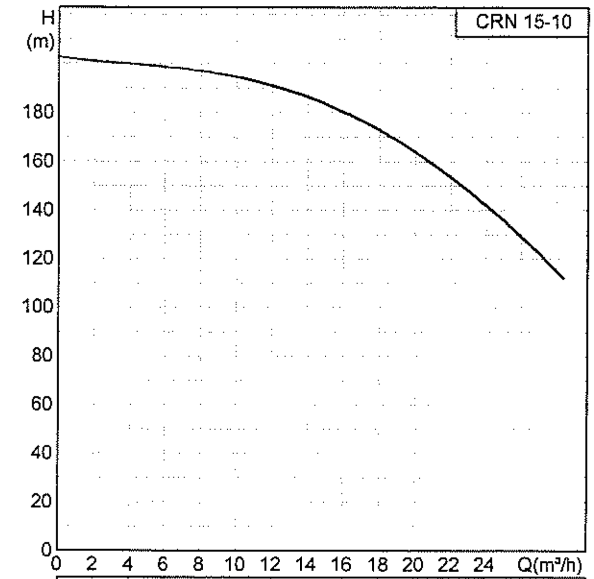
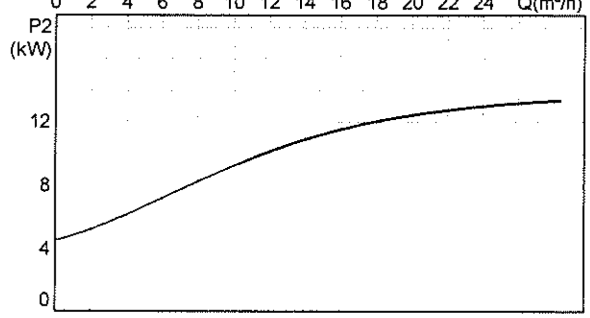
Description	Value
Product name:	CRN 15-10 A-P-G-V HQQV
Product No:	96523510
EAN number:	5700396906140
Technical:	
Speed for pump data:	3497 rpm
Rated flow:	20.5 m³/h
Rated head:	162 m
Impellers:	10
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A
Stages:	10
Pump version:	A
Model:	A
Cooling:	ODP
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	V
Installation:	
Maximum ambient temperature:	313 K
Max pressure at stated temp:	25 / 90 bar / °C 25 / -20 bar / °C
Flange standard:	PJE (Victaulic)
Connect code:	P
Pipe connection:	2 3/8"
Flange size for motor:	254TC
Liquid:	
Liquid temperature range:	253 .. 363 K
Electrical data:	
Motor type:	254TC
Number of poles:	2
Rated power - P2:	15 kW
Power (P2) required by pump:	15 kW
Mains frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated speed:	3525 rpm
Enclosure class (IEC 34-5):	IP23
Insulation class (IEC 85):	B
Motor protec:	NONE
Motor No:	84Z03374
Others:	
Net weight:	128 kg
Shipping volume:	0.34 m³





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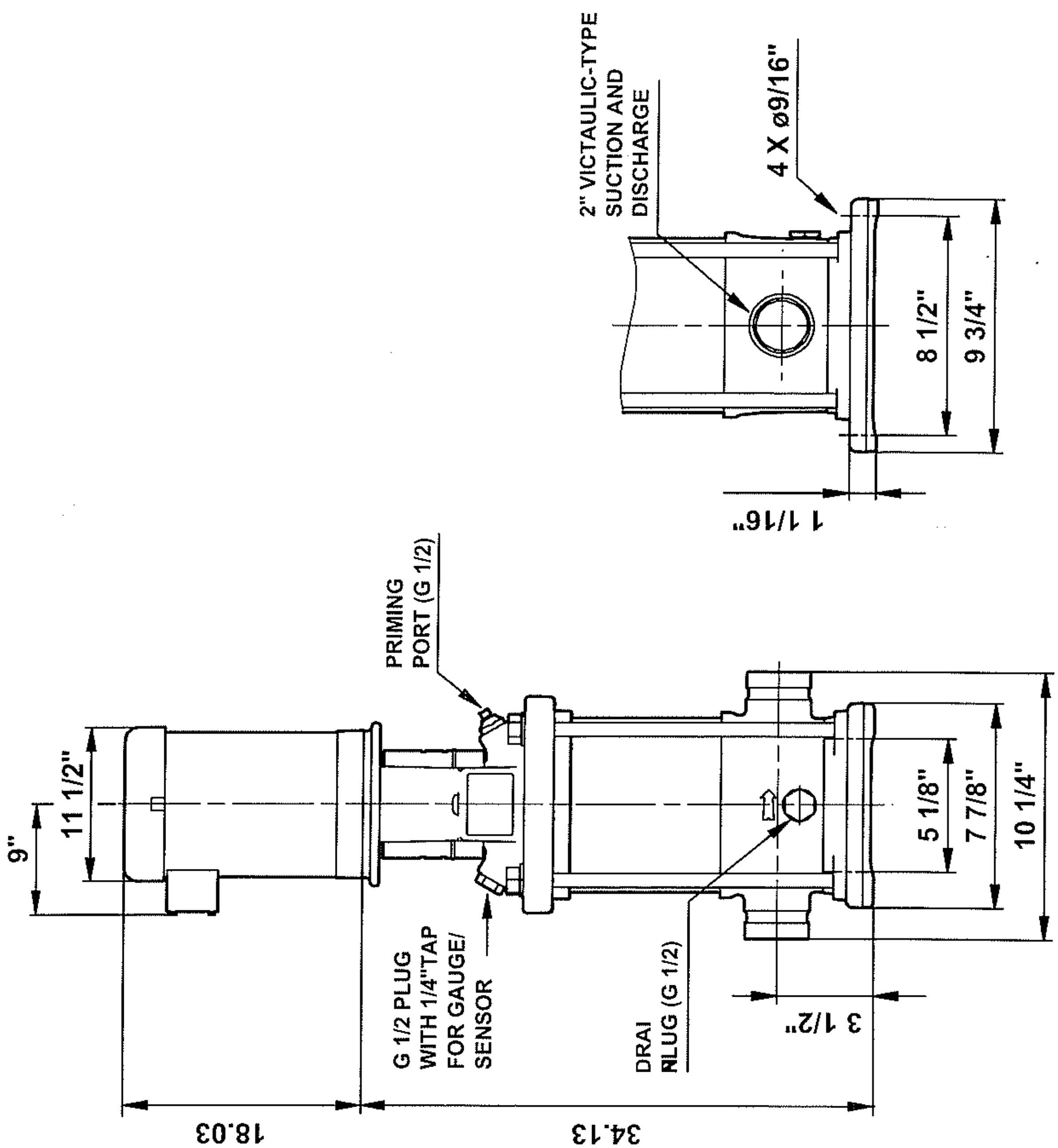
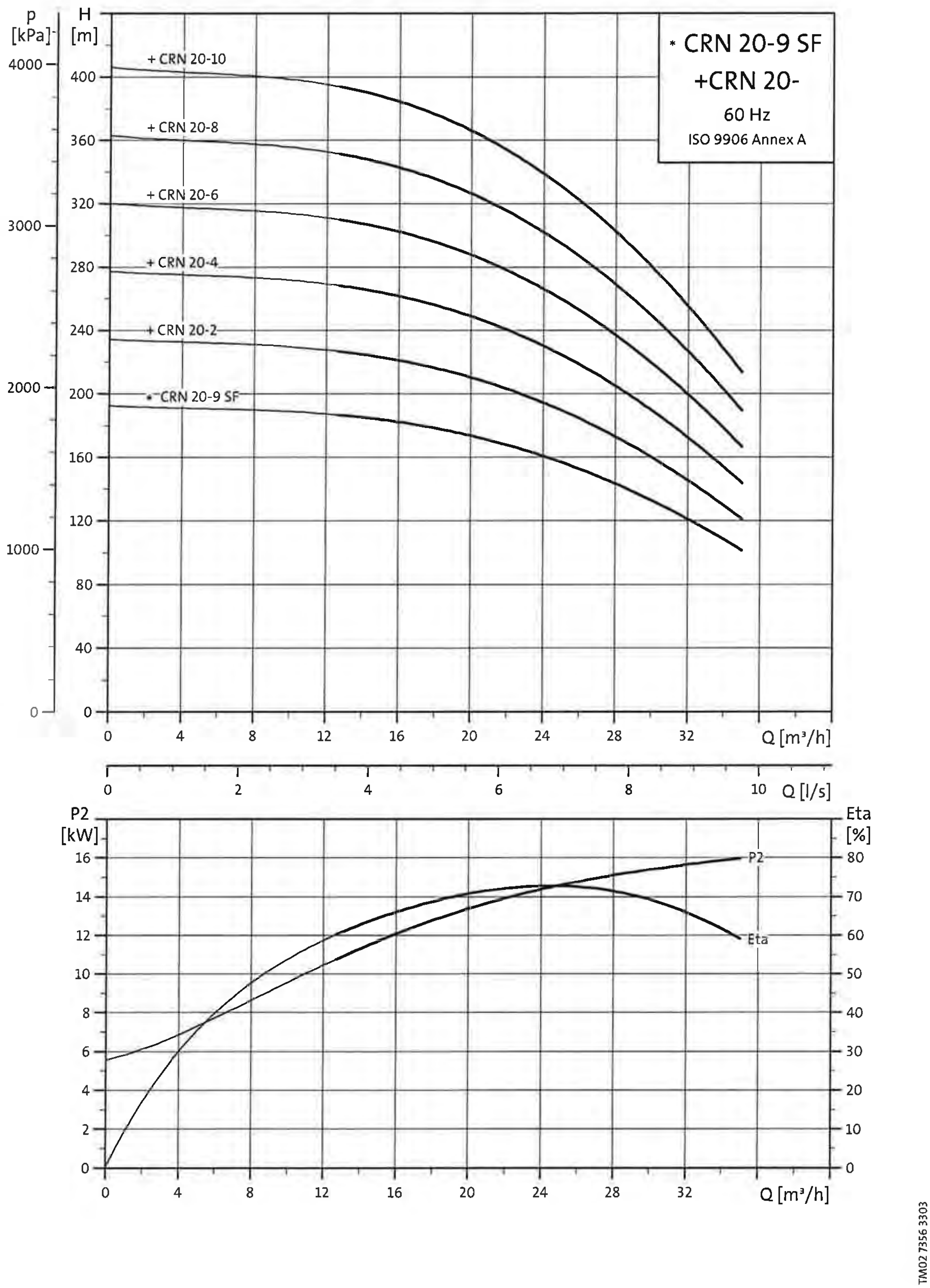
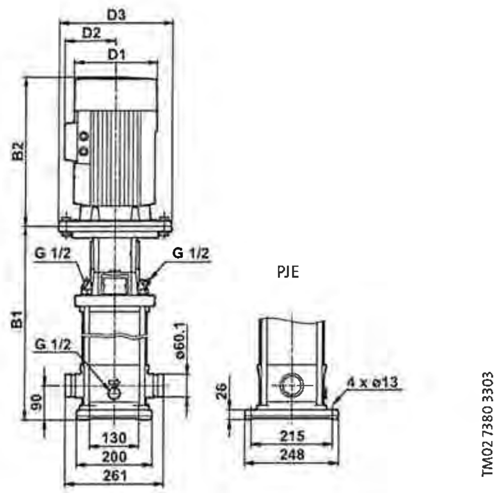


Note! All units are in [mm] unless others are stated.

Performance curves

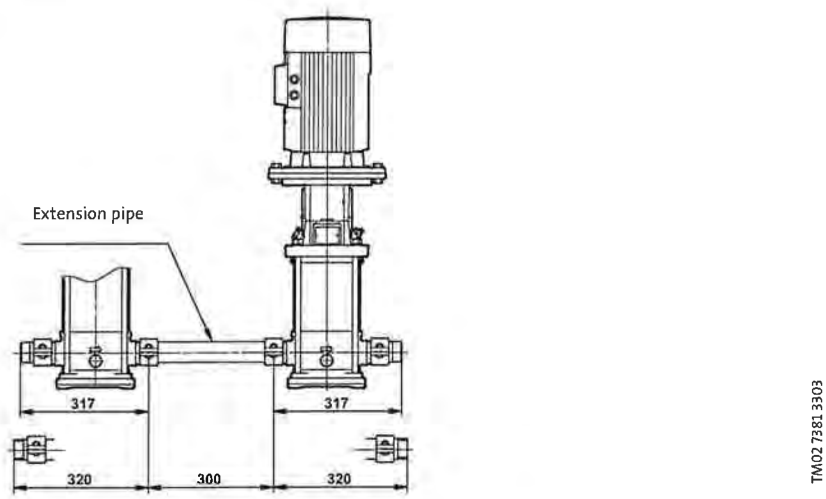


Dimensional sketches



Dimensions and weights

Pump type	Dimensions [mm]						Net weight [kg]
	B1	B2	B1 + B2	D1	D2	D3	
CRN 20-2	417	372	789	220	134	-	61
CRN 20-4	539	391	930	220	134	300	87
CRN 20-6	706	464	1170	260	172	352	120
CRN 20-8	796	478	1274	306	197	352	138
CRN 20-10	886	478	1364	306	197	352	151
CRN 20-9 SF	887	478	1365	319	197	350	146



Electrical data

3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor P_2 [kW]	Full load current $I_{1/1}$ [A]	Power factor Cos φ 1/1	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$
CRN 20-2	4.0	13.6-11.4/7.85-6.60	0.92-0.85	86.0-87.0	8.00-12.0
CRN 20-4	7.5	25.5-22.6/14.6-13.0	0.92-0.80	87.5-89.0	9.50-11.6
CRN 20-6	11.0	38.0-32.5/22.0-18.8	0.92-0.86	89.0-91.0	6.80-8.60
CRN 20-8	15.0	48.8-41.0/28.1-23.7	0.91-0.86	90.0-92.0	5.40-9.15
CRN 20-10	18.5	58.7-56.8/34.0-32.8	0.87	91.0-93.0	6.0-7.9
CRN 20-9 SF	18.5	58.7-56.8/34.0-32.8	0.87	91.0-93.0	6.0-7.9

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Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	*Count*	*Description*	*Unit price*
	1	**CRN 20-10 A-P-G-V HQQV** Product No.: 96524111 Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation. **The pump has the following characteristics:** - Impellers, intermediate chambers and outer sleeve are made of Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr.. - Pump head cover and base are made of Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr.. - The shaft seal has assembly length according to DIN 24960. - Power transmission is via cast iron split coupling. - Pipework connection is via PJE (Victaulic) flanges/couplings. The motor is a 3-phase AC motor. **Liquid:** Liquid temperature range: -4 .. 194 °F **Technical:** Speed for pump data: 3521 rpm Rated flow: 111.4 US GPM Rated head: 561 ft Shaft seal: HQQV Approvals on nameplate: NEMA Curve tolerance: ISO 9906 Annex A **Materials:** Pump housing: Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM Impeller: Stainless steel 1.4401 DIN W.-Nr. 316 AISI **Installation:** Maximum ambient temperature: 104 °F Max pressure at stated temp: 363 / 194 psi/°F 363 / -4 psi/°F Flange standard: PJE (Victaulic) Pipe connection: 2 3/8" Flange size for motor: 284TC **Electrical data:** Motor type: 286TSC Efficiency class: S Number of poles: 2 Rated power - P2: 25 HP Power (P2) required by pump: 25 HP Main frequency: 60 Hz	On request

Position	Count	Description	Unit price
		Rated voltage: 3 x 230 / 460 V	
		Rated current: 57 / 28.5 A	
		Rated speed: 3525 rpm	
		Motor efficiency at full load: 91.7 %	
		Others:	
		Net weight: 364 lb	
		Shipping volume: 12 ft³	

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	Count	Description	Unit price
	1	**CRN 20-10 A-P-G-V HQQV**	On request

Product photo could vary from the actual product

Product No.: 96524111
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:
- Impellers, intermediate chambers and outer sleeve are made of
Stainless steel DIN W.-Nr. 1.4401 DIN W.-Nr..
- Pump head cover and base are made of
Stainless steel DIN W.-Nr. 1.4408 DIN W.-Nr..
- The shaft seal has assembly length according to DIN 24960.
- Power transmission is via cast iron split coupling.
- Pipework connection is via PJE (Victaulic) flanges/couplings.

The motor is a 3-phase AC motor.

Liquid:

Liquid temperature range:	-4 .. 194 °F

Technical:

Speed for pump data:	3521 rpm
Rated flow:	111.4 US GPM
Rated head:	561 ft
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Position	Count	Description	Unit price

Installation:

Maximum ambient temperature:	104 °F
Max pressure at stated temp:	363 / 194 psi/°F
	363 / -4 psi/°F
Flange standard:	PJE (Victaulic)
Pipe connection:	2 3/8"
Flange size for motor:	284TC

Electrical data:

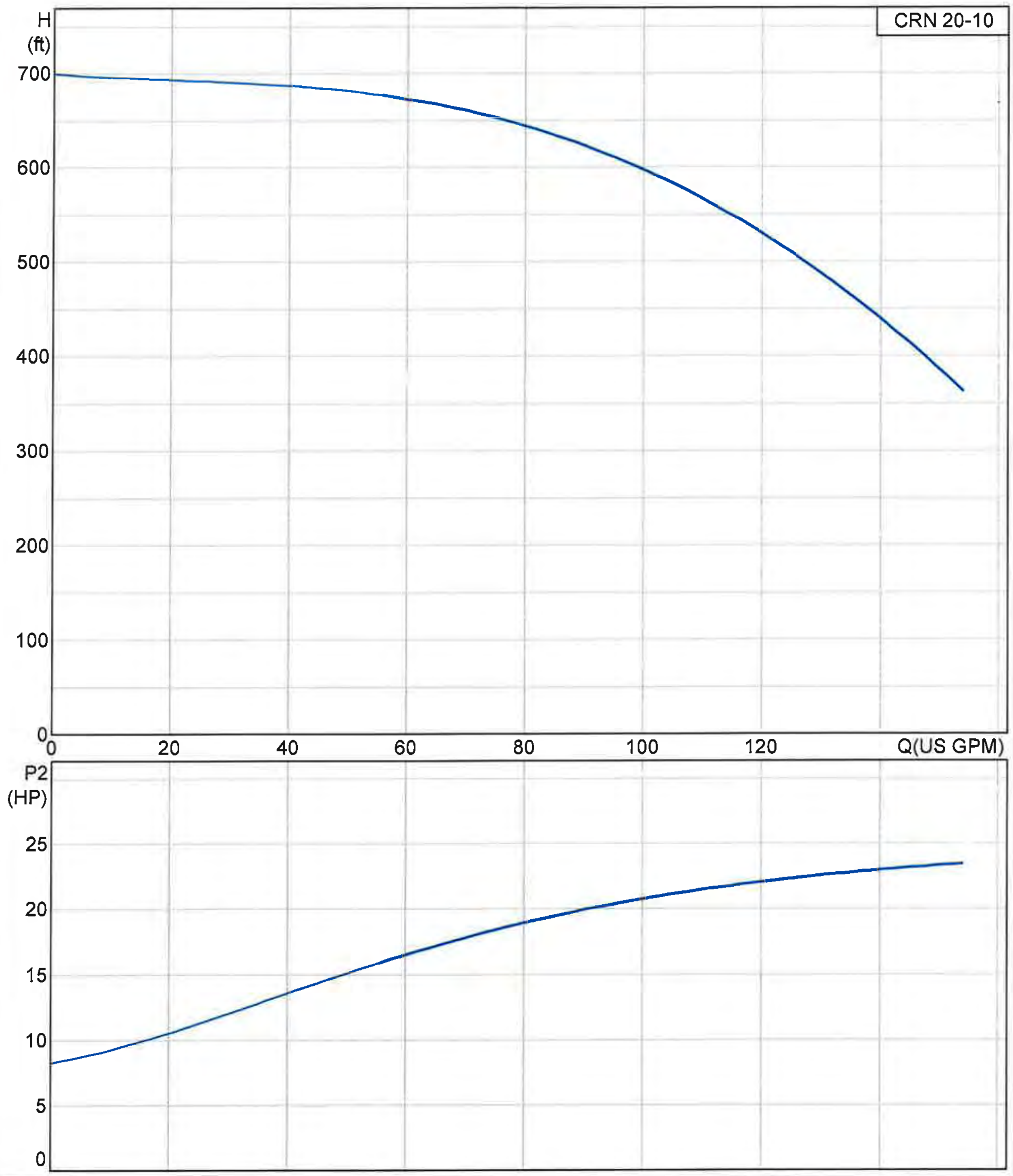
Motor type:	286TSC
Efficiency class:	S
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated current:	57 / 28.5 A
Rated speed:	3525 rpm
Motor efficiency at full load:	91.7 %

Others:

Net weight:	364 lb
Shipping volume:	12 ft³

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

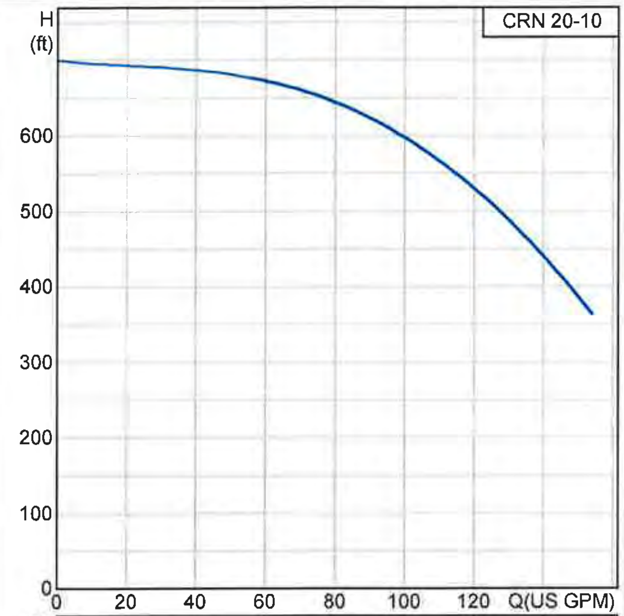
96524111 CRN 20-10

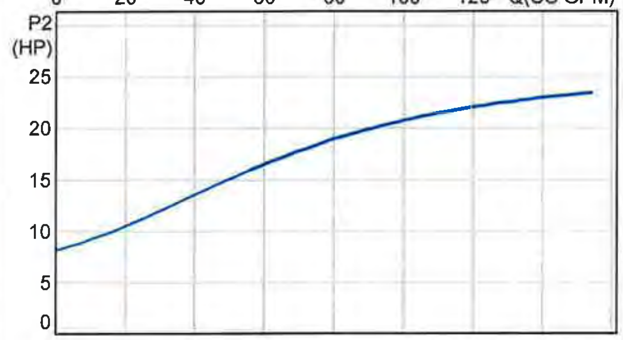


GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Description	Value
Product name:	CRN 20-10 A-P-G-V HQQV A-P-G-V HQQV
Product Number:	96524111
EAN number:	5700396917719
Technical:	
Speed for pump data:	3521 rpm
Rated flow:	111.4 US GPM
Rated head:	561 ft
Impellers:	10
Shaft seal:	HQQV
Approvals on nameplate:	NEMA
Curve tolerance:	ISO 9906 Annex A
Stages:	10
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	V
Installation:	
Maximum ambient temperature:	104 °F
Max pressure at stated temp:	363 / 194 psi/°F 363 / -4 psi/°F
Flange standard:	PJE (Victaulic)
Connect code:	P
Pipe connection:	2 3/8"
Flange size for motor:	284TC
Liquid:	
Liquid temperature range:	-4 .. 194 °F
Electrical data:	
Motor type:	286TSC
Efficiency class:	S
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 230 / 460 V
Rated current:	57 / 28.5 A
Rated speed:	3525 rpm
Motor efficiency at full load:	91.7 %
Motor protection:	NONE
Motor Number:	85600026
Others:	
Net weight:	364 lb
Shipping volume:	12 ft³





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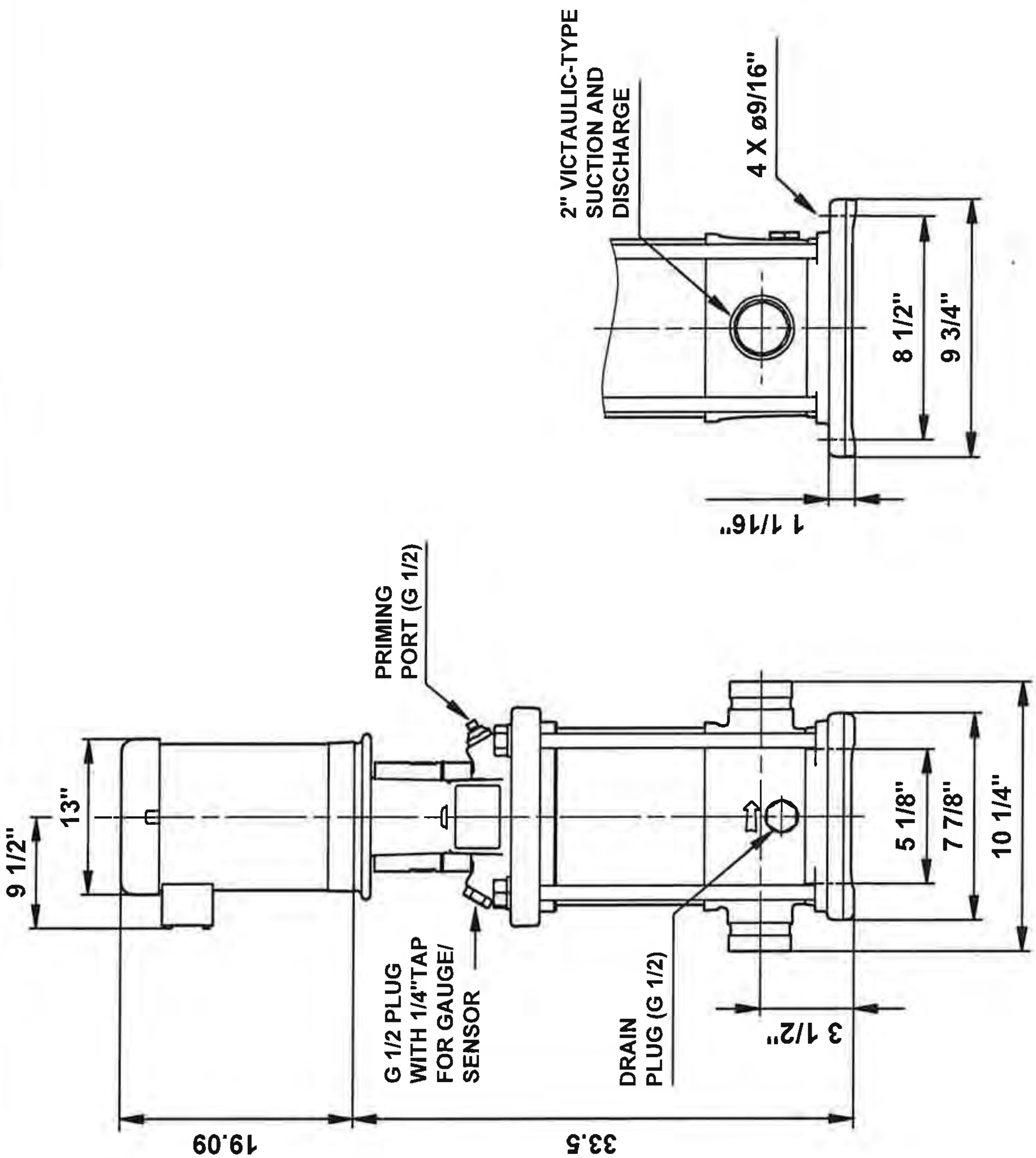
96524111 CRN 20-10



All units are [mm] unless otherwise presented.

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	Count	Description	Unit price
	1	**CRN 20-9 SF SF-P-G-E HQQE** Product No.: 96512264	On request

Vertical, non-self-priming high-pressure pump with inline suction and discharge ports of identical diameter and reverse hydraulics and flow direction (high-pressure version). Pump hydraulics consisting of base, pump head of lost-wax cast stainless steel and stainless steel impellers with floating PTFE neck rings.

Base and pump head are connected by means of stay bolts and a stainless steel sleeve.

Motor and pump shafts are connected via a balanced 2 piece coupling. Hard wearing cartridge shaft seal for easy replacement. Pumps of 15 hp and up with spacer coupling.

Surface-cooled 3-phase motor with power and main dimensions according to DIN/IEC.

Liquid:

Liquid temperature range:	-22 .. 248 °F

Technical:

Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Installation:

Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC
Flange standard:	PJE
Pipe connection:	60,1 mm
Flange size for motor:	FF300

Electrical data:

Motor type:	160L
Efficiency class:	1
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 380-480 D / 660-690 Y V
Rated current:	34,0-26,5 / 19,6-18,4 A
Starting current:	580-880 %
Cos phi - power factor:	0,93-0,92
Rated speed:	3510-3550 rpm

Position	Count	Description		Unit price
		Motor efficiency at full load:	89,0-91,0 %	
		Motor efficiency at 3/4 load:	90,0-90,5 %	
		Enclosure class (IEC 34-5):	IP55	
		Insulation class (IEC 85):	F	
		Others:		
		Net weight:	322 lb	

GRUNDFOS

Company name: -
Created by: -
Phone: -
Fax: -
Date: -

Position	Count	Description	Unit price
	1	CRN 20-9 SF SF-P-G-E HQQE	On request

Product photo could vary from the actual product

Product No.: 96512264

Vertical, non-self-priming high-pressure pump with inline suction and discharge ports of identical diameter and reverse hydraulics and flow direction (high-pressure version).
Pump hydraulics consisting of base, pump head of lost-wax cast stainless steel and stainless steel impellers with floating PTFE neck rings.

Base and pump head are connected by means of stay bolts and a stainless steel sleeve.

Motor and pump shafts are connected via a balanced 2 piece coupling. Hard wearing cartridge shaft seal for easy replacement. Pumps of 15 hp and up with spacer coupling.

Surface-cooled 3-phase motor with power and main dimensions according to DIN/IEC.

Liquid:

Liquid temperature range:	-22 .. 248 °F

Technical:

Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A

Materials:

Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI

Installation:

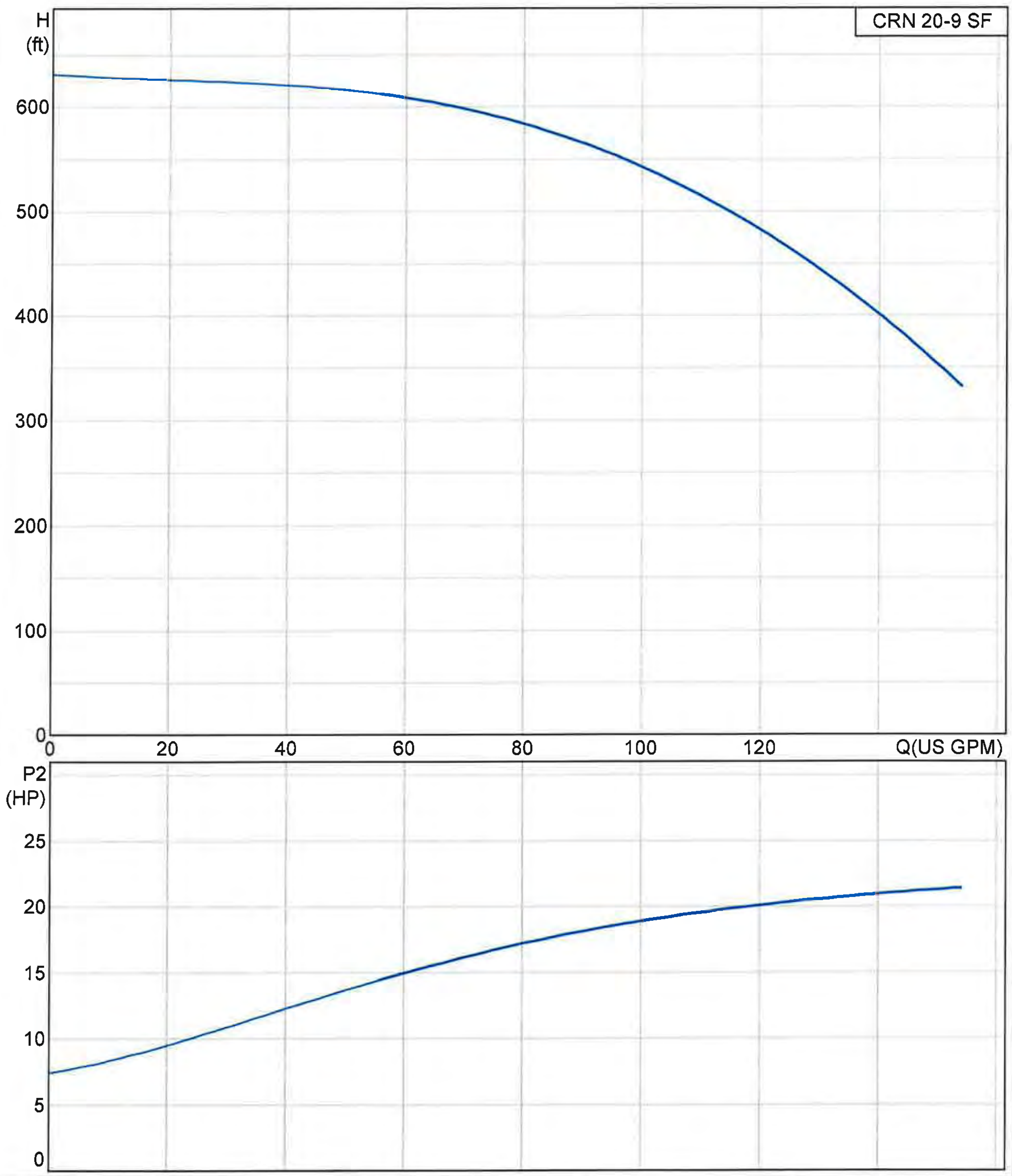
Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC

Position	Count	Description		Unit price
		Flange standard:	PJE	
		Pipe connection:	60,1 mm	
		Flange size for motor:	FF300	
		Electrical data:		
		Motor type:	160L	
		Efficiency class:	1	
		Number of poles:	2	
		Rated power - P2:	25 HP	
		Power (P2) required by pump:	25 HP	
		Main frequency:	60 Hz	
		Rated voltage:	3 x 380-480 D / 660-690 Y V	
		Rated current:	34,0-26,5 / 19,6-18,4 A	
		Starting current:	580-880 %	
		Cos phi - power factor:	0,93-0,92	
		Rated speed:	3510-3550 rpm	
		Motor efficiency at full load:	89,0-91,0 %	
		Motor efficiency at 3/4 load:	90,0-90,5 %	
		Enclosure class (IEC 34-5):	IP55	
		Insulation class (IEC 85):	F	
		Others:		
		Net weight:	322 lb	

GRUNDFOS

Company name:	-
Created by:	-
Phone:	-
Fax:	-
Date:	-

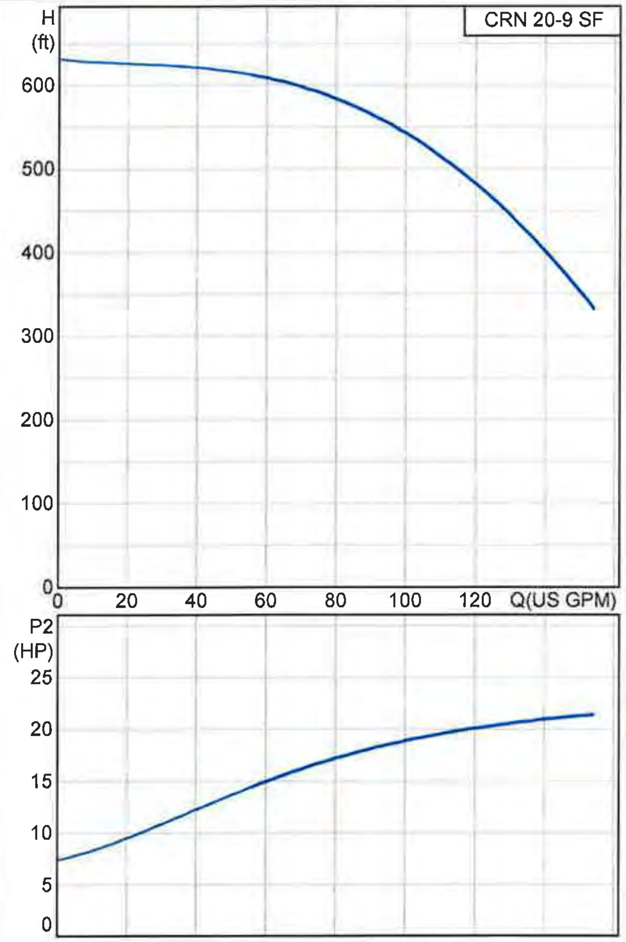
96512264 CRN 20-9 SF



GRUNDFOS

Company name:	-
Created by:	-
Phone:	-
Fax:	-
Date:	-

Description	Value
Product name:	CRN 20-9 SF SF-P-G-E HQQE SF-P-G-E HQQE
Product Number:	96512264
EAN number:	5700396600505
Technical:	
Speed for pump data:	3540 rpm
Rated flow:	111.4 US GPM
Rated head:	511 ft
Impellers:	09
Shaft seal:	HQQE
Approvals on nameplate:	CE
Curve tolerance:	ISO 9906 Annex A
Stages:	09
Pump version:	SF
Model:	A
Materials:	
Pump housing:	Stainless steel 1.4408 DIN W.-Nr. A 351 CF 8M ASTM
Impeller:	Stainless steel 1.4401 DIN W.-Nr. 316 AISI
Material code:	G
Code for rubber:	E
Installation:	
Maximum ambient temperature:	122 °F
Max pressure at stated temp:	725 / 250 psi/°F 50/-30 t_bardgC
Flange standard:	PJE
Connect code:	P
Pipe connection:	60,1 mm
Flange size for motor:	FF300
Liquid:	
Liquid temperature range:	-22 .. 248 °F
Electrical data:	
Motor type:	160L
Efficiency class:	1
Number of poles:	2
Rated power - P2:	25 HP
Power (P2) required by pump:	25 HP
Main frequency:	60 Hz
Rated voltage:	3 x 380-480 D / 660-690 Y V
Rated current:	34,0-26,5 / 19,6-18,4 A
Starting current:	580-880 %
Cos phi - power factor:	0,93-0,92
Rated speed:	3510-3550 rpm
Motor efficiency at full load:	89,0-91,0 %
Motor efficiency at 3/4 load:	90,0-90,5 %
Enclosure class (IEC 34-5):	IP55
Insulation class (IEC 85):	F
Motor protection:	PTC
Motor Number:	96619111
Others:	
Net weight:	322 lb



GRUNDFOS

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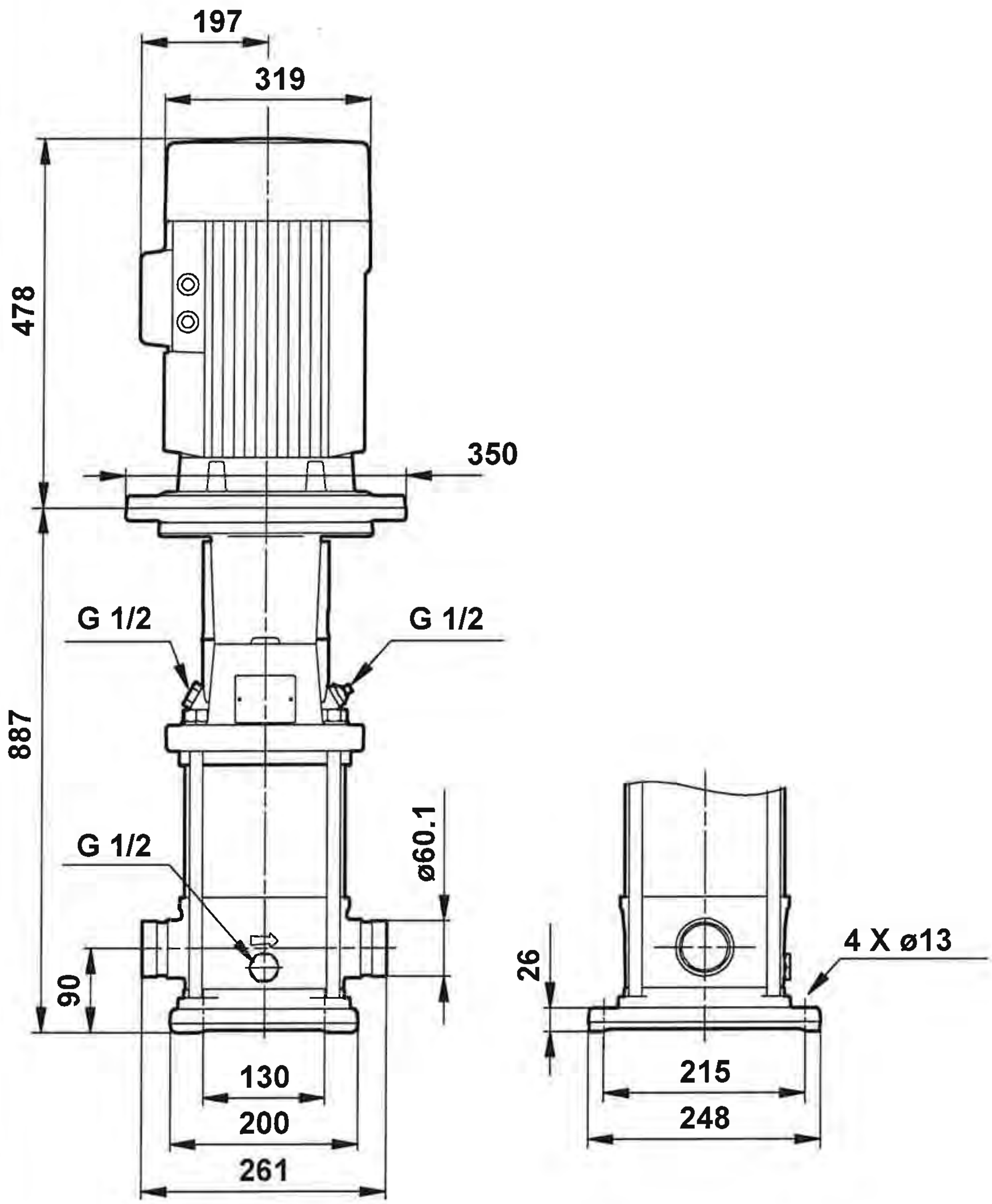
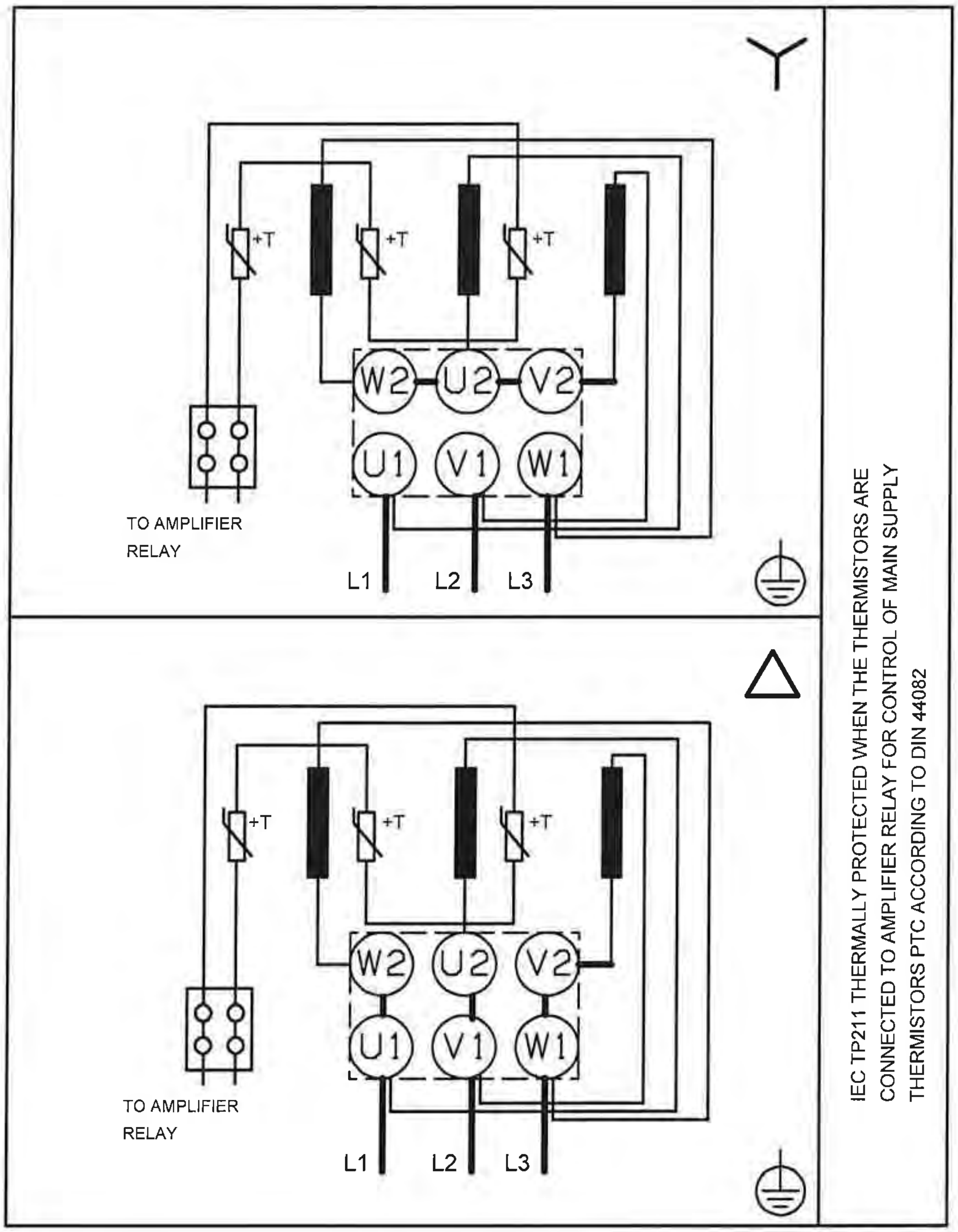
96512264 CRN 20-9 SF



All units are [mm] unless otherwise presented.

96512264 CRN 20-9 SF



All units are [mm] unless otherwise presented.

ProCam[MD]
Diaphragm Metering Pumps

Superior Design – Exceptional Value, Fast Delivery

ProCam[MD] diaphragm metering pumps set the standard for ease of operation and reliability in the medium duty chemical metering market. Precision metering for single point injection to 80 GPH (3,000 l/h) and up to 300 psi (20 bar) is now available in a Bran+Luebbe diaphragm pump at an incredible value.


DS15 with Stainless Steel Pumphead

Applications

The ProCam[MD] is the best in class in the medium duty market. Including…

- Chemical
- Food & Beverage
- Pulp & Paper
- Utilities
- Water Treatment
- …and many more

Advantages

Economical Pumping of All Types of Liquids

- Unique double diaphragm design provides superior service life.
- Diaphragm monitoring system signals the onset of diaphragm wear.
- Metered liquid is protected from contamination by packing wear or pump lubricant.
- Adjustments to the pumphead are not required.
- Leak free, hermetically sealed fluid end.

Features

Metering Pumphead Design

- Mechanically actuated PTFE double-diaphragm.
- Diaphragm condition monitoring system with pressure gauge or optional pressure switch.
- Materials of construction:
  - 316 Stainless Steel
  - Alloy 20
  - PVC
  - PVDF (Kynar)

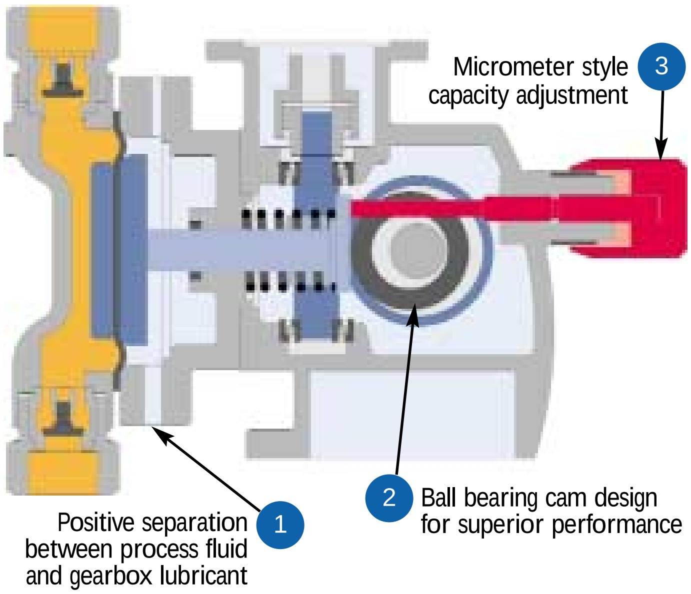
Robust Gear Technology

- Proven cam/spring design for long operating life.
- Linear stroke length adjustment.
- Rugged cast iron construction with bearing guided cam and shaft.

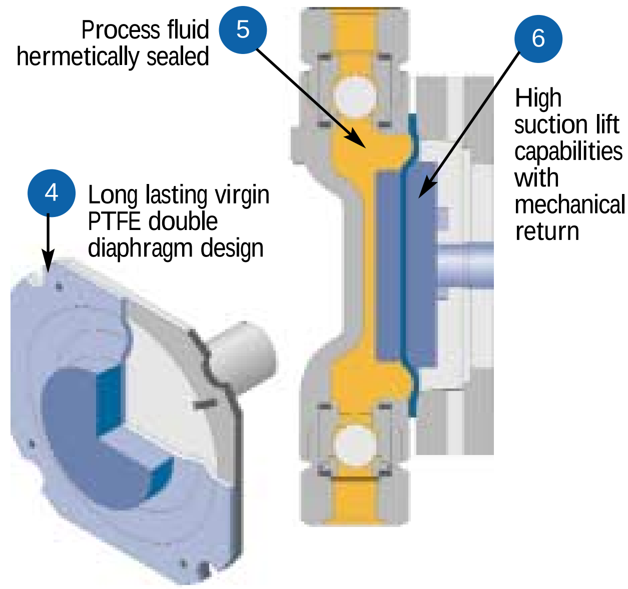
Motor

- 1/3 up to 1 HP TEFC 56C NEMA frame. (0.25 or 0.75 kw TEFC (IP54) IEC)
- Single phase or three phase voltage.
- Variable speed available as an option.

ProCam[MD]: Mechanically Actuated Diaphragm Pumphead with Simple Drive Operation.



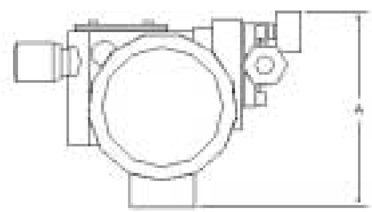
Standard Double Diaphragm Pumphead Design



TECHNICAL DATA

Pump Type	Capacity in GPH* per stroke speed**				Connection	Max. Press	Materials of Construction	Dimensions			Approx. Wts.
	64	94	127	188	NPTF	PSIG		A	B	C	LBS.
DS 15	1.8	2.7	3.6	5.4	3/8”	300	316SS/Alloy 20	7.87”	12.25”	19.5”	40
DP 15						150	PVC/PVDF		12.87”		37
DS 50	6	9	12	18	3/8”	150	316SS/Alloy 20	8”	11.87”	19.5”	40
DP 50							PVC/PVDF		12.87”		37
DS 200	27	40	54	80	1/2”	175	316SS/Alloy 20	9.25”	13.5”	19.5”	65
DP 200						150	PVC/PVDF		16”	20.5”	64

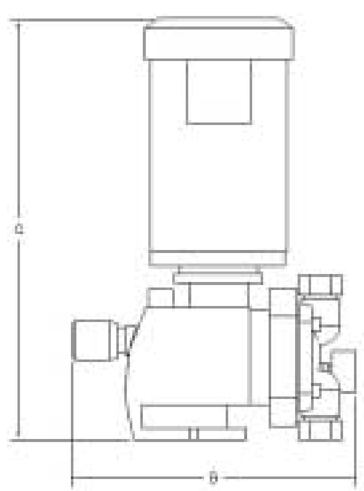
* Note: Values at 100% volumetric efficiency.
** At 64 & 94 spm, motor RPM is 1750.
** At 127 & 188 spm, motor RPM is 3500.



TECHNICAL DATA

Pump Type	Capacity in LPH* per stroke speed**				Connection	Max. Press	Materials of Construction	Dimensions mm			Approx. Wts.
	50	72	100	144	mm	BAR		A	B	C	KG
DS 15	5.3	7.8	10.6	15.6	9	20	316SS/Alloy 20	200	311	495	18
DP 15						10	PVC/PVDF		327		16.8
DS 50	17.5	26	35	52	9	10	316SS/Alloy 20	203	302	495	18
DP 50							PVC/PVDF		327		16.8
DS 200	79	115	158	230	13	12	316SS/Alloy 20	235	343	495	29.5
DP 200						10	PVC/PVDF		406	521	29

* Note: Values at 100% volumetric efficiency.
** At 50 & 72 spm, motor RPM is 1400.
** At 100 & 144 spm, motor RPM is 2800.



BRAN+LUEBBE

SPX Process Equipment

ProCam MD - Part Number Code

Model	Material	Ratio	Connection	Diaphragm Monitor	Motor Adapter	Motor	Ident Number
MD15-S	316ss	28:1	3/8" NPTF	gauge	56C	none	**MD015S28111-000**
MD15-S	316ss	19:1	3/8" NPTF	gauge	56C	none	**MD015S19111-000**
MD15-A	Alloy 20	28:1	3/8" NPTF	gauge	56C	none	**MD015A28111-000**
MD15-A	Alloy 20	19:1	3/8" NPTF	gauge	56C	none	**MD015A19111-000**
MD15-P	PVC	28:1	3/8" NPTF	gauge	56C	none	**MD015P28111-000**
MD15-P	PVC	19:1	3/8" NPTF	gauge	56C	none	**MD015P19111-000**
MD15-K	Kynar	28:1	3/8" NPTF	gauge	56C	none	**MD015K28111-000**
MD15-K	Kynar	19:1	3/8" NPTF	gauge	56C	none	**MD015K19111-000**
MD50-S	316ss	28:1	3/8" NPTF	gauge	56C	none	**MD050S28111-000**
MD50-S	316ss	19:1	3/8" NPTF	gauge	56C	none	**MD050S19111-000**
MD50-A	Alloy 20	28:1	3/8" NPTF	gauge	56C	none	**MD050A28111-000**
MD50-A	Alloy 20	19:1	3/8" NPTF	gauge	56C	none	**MD050A19111-000**
MD50-P	PVC	28:1	3/8" NPTF	gauge	56C	none	**MD050P28111-000**
MD50-P	PVC	19:1	3/8" NPTF	gauge	56C	none	**MD050P19111-000**
MD50-K	Kynar	28:1	3/8" NPTF	gauge	56C	none	**MD050K28111-000**
MD50-K	Kynar	19:1	3/8" NPTF	gauge	56C	none	**MD050K19111-000**
MD200-S	316ss	28:1	1/2" NPTF	gauge	56C	none	**MD200S28111-000**
MD200-S	316ss	19:1	1/2" NPTF	gauge	56C	none	**MD200S19111-000**
MD200-A	Alloy 20	28:1	1/2" NPTF	gauge	56C	none	**MD200A28111-000**
MD200-A	Alloy 20	19:1	1/2" NPTF	gauge	56C	none	**MD200A19111-000**
MD200-P	PVC	28:1	1/2" NPTF	gauge	56C	none	**MD200P28111-000**
MD200-P	PVC	19:1	1/2" NPTF	gauge	56C	none	**MD200P19111-000**
MD200-K	Kynar	28:1	1/2" NPTF	gauge	56C	none	**MD200K28111-000**
MD200-K	Kynar	19:1	1/2" NPTF	gauge	56C	none	**MD200K19111-000**

Part Number Code:

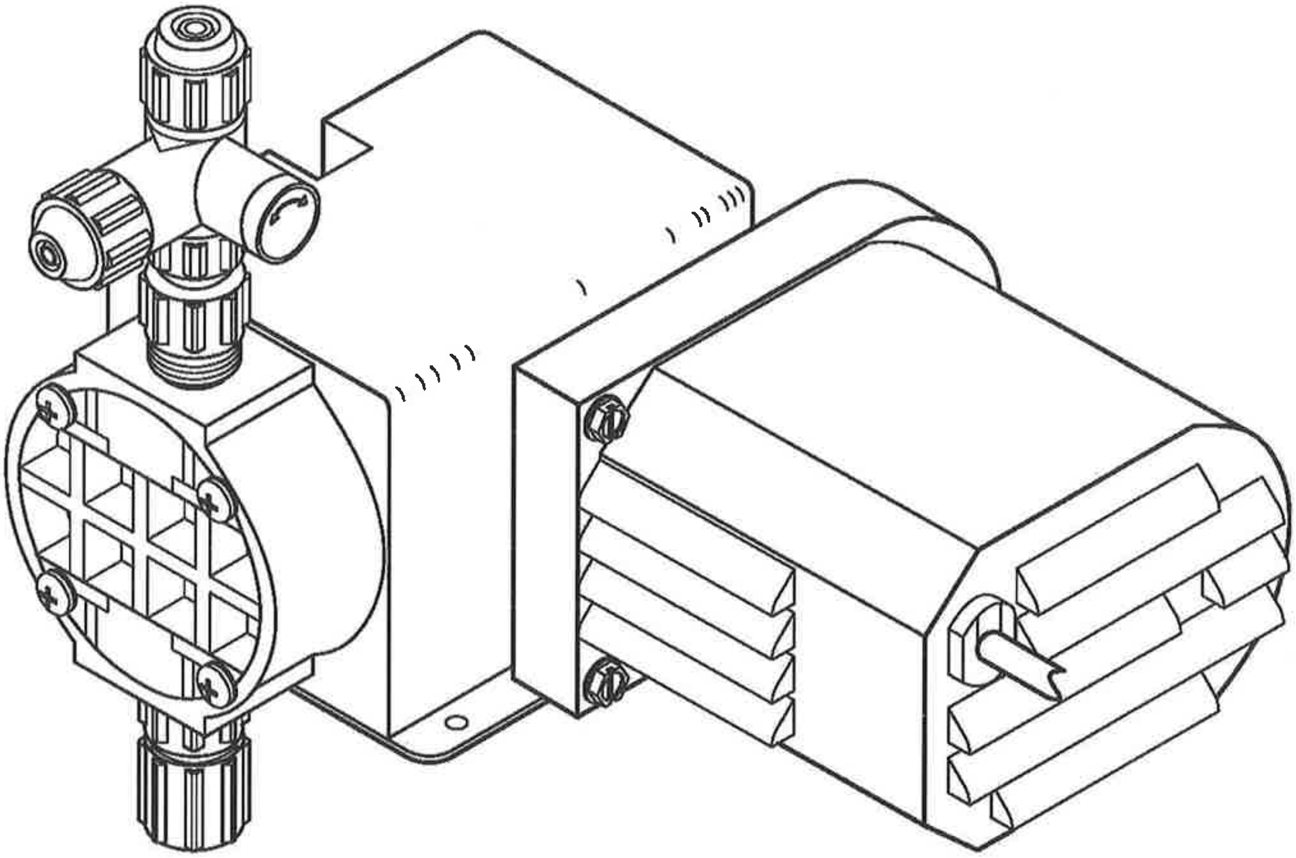
MD	**200**	**S**	**28**	**1**	**1**	**1**	**- 000**
Product	Size	Material	Ratio	Connection	Diaphragm Monitor	Motor Adapter	Motor (60 hz, TEFC)
MD	15 50 200	S = 316ss A = Alloy 20 P = PVC w/ EPDM K =PVDF w/ EPDM Y = PVC w/ FPM* Z= =PVDF w/ FPM*	28 = 28:1 19 = 19:1	0 = none 1 = NPTF	0=none 1=gauge 2=switch 3 = gauge & vent 4 = switch & vent	0=none 1 = 56C	000 = none 001 = 1/3hp, 1800rpm, 3ph 002 = 1/3hp, 1800rpm, 1ph 003 = 1/3hp, 3600rpm, 3ph 004 = 1/3hp, 3600rpm, 1ph 005 = 3/4hp, 3600rpm, 1ph 006 = 3/4hp, 1800rpm, 3ph 007 = 3/4hp, 1800rpm, 1ph 008 = 3/4hp, 3600rpm, 3ph 009 = 1hp, 1800rpm, 3ph 010 = 1hp, 1800rpm, 1ph 011 = 1hp, 3600rpm, 3ph 012 = 1hp, 3600rpm, 1ph

* Optional FPM O-rings and Teflon gaskets replace standard EPDM valve seals.

FPM = Viton

READ ALL CAUTIONS CAREFULLY BEFORE INSTALLING PUMP

SEE PAGE (4)



SERIES 100/150

INSTRUCTION MANUAL

P/N 32040
Rev B

CE

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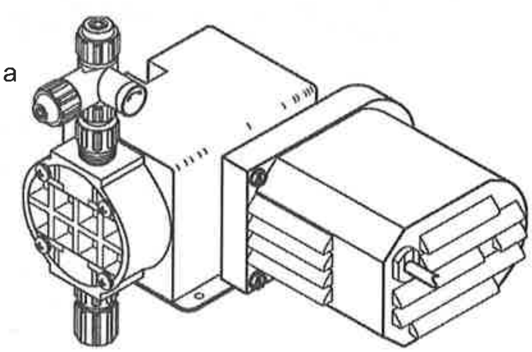
SAFETY INSTRUCTIONS

READ ALL INSTRUCTIONS PRIOR TO USE

⚠ DANGER Secure chemicals & metering pumps, making them inaccessible to children & pets.
*** **DO NOT PUMP FLAMMABLE LIQUIDS.**
*** Do not cut the plug or ground lug off the electrical cord. Consult a licensed electrician for proper installation or replacement.
⚠ WARNING To reduce the risk of electrical shock-before maintenance, repair, or moving, always disconnect the power to the pump by unplugging from wall outlet.
⚠ WARNING Always wear protective clothing, including gloves and safety glasses, when working on or near chemical metering pumps.
** Inspect tubing regularly for cracking or deterioration and replace as necessary. **(Always wear protective clothing and safety glasses when inspecting tubing.)**
** Use **CAUTION** to keep fingers away from rotating parts.
** If pump is exposed to direct sunlight, use a UV resistant tubing.
** Follow directions and warnings provided from the chemical manufacturer. The user is responsible for determining the chemical compatibility with the chemical feed pump.
** Make sure the voltage on the pump name tag matches the installation voltage. If pump fails to start, check line voltage.
** Consult with local health officials and/or qualified water conditioning specialists when treating potable water.
** Always depressurize system prior to installation or disconnecting the metering pump tubing.
** If injection point is lower than the chemical tank and pump, install an anti-siphon valve.
** **DO NOT MODIFY PUMP.** This poses a potentially dangerous situation and will void the warranty. Hand tighten plastic connections **(Do not use wrench)**.
⚠ CAUTION All pumps are factory tested with water. Remove tubing and thoroughly dry if the chemical being pumped will react with water (for example sulfuric acid).
* Hand tighten plastic connections **(Do not use wrench)**.
* Consult licensed plumber and electrician before installation to conform to local codes.
* **NOTE:** For accurate volume output, pump must be calibrated under all operating conditions.

INTRODUCTION



Series 100/150 are diaphragm-type metering pumps. A fluid is pumped from a chemical storage tank to the point of injection by the pulsing action of the diaphragm. The four check valves (top and bottom of pump head, strainer assembly, and injection assembly) keep the fluid flowing toward the point of discharge. To insure the solution being pumped can only go forward, it is important that all check valves provide positive, non-leaking backflow prevention. The wetted end (those parts that contact the solution being pumped) is constructed of SAN, PVC, TFE, Hypalon®, and polyethylene. These materials are very resistant to most chemicals. However, there are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as diaphragm, valve seat, or head. Alternate materials such as Viton®, polypropylene is available on request. Contact chemical supplier for chemical compatible materials.

■ MANUFACTURER'S PRODUCT WARRANTY

The manufacturer warrants its equipment of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for twenty-four (24) months from the date of purchase or one (1) year from date of installation or whichever comes first. The manufacturer's liability is limited to repair or replacement of any device or part which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through use of its products.

The above warranty is in lieu of any other warranty, either expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to make any warranty other than the above.

For warranty and service matters within the European Union, contact the seller first or:

Pulsafeeder, Inc. Europe
Units 12 and 13, Edison Road
Highfield Industrial Estates
Eastbourne, East Sussex BN23 6PT

PRECAUTIONS FOR OPERATION

Each Series 100/150 chemical feeder has been tested to meet prescribed specifications and certain safety standards. However, a few precautionary notes should be adhered to at all times. THOROUGHLY READ ALL CAUTIONS PRIOR TO INSTALLING METERING PUMP.

⚠ CAUTION

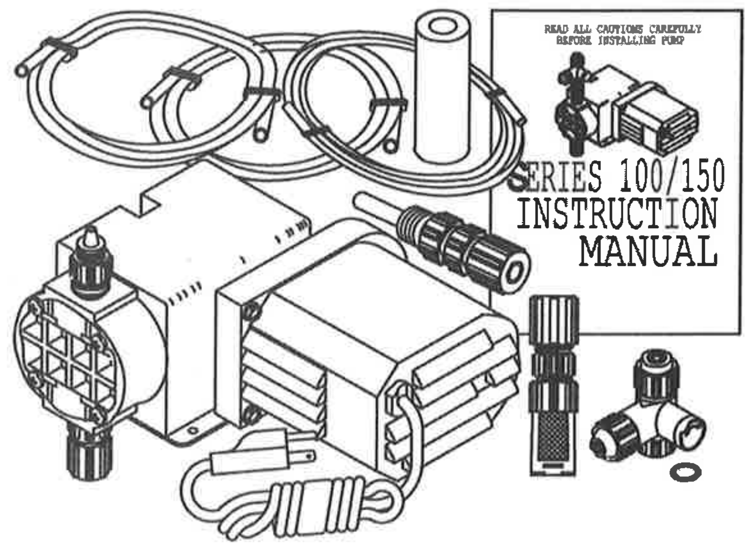
1. Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children and others. We cannot be responsible for the misuse of chemicals being fed by the pump.
2. Always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps.
3. Tampering with electrical devices can be potentially hazardous. Always place chemicals and feeder installation well out of the reach of children and others.
4. Be careful to check that the voltage of the installation matches the voltage indicated on the specification label. Each pump is equipped with a three prong plug. Whether plugging into a receptacle or wiring into a system, always be sure the feeder is grounded. If receptacle is utilized, to disconnect, do not pull wire but grip the plug with fingers and pull out.
5. Never repair or move the metering pump while operating. Always disconnect electrical current. Before handling the pump always allow sufficient time for the motor housing to cool off. Handling the pump too soon after shutdown may cause hand burns. For safety use protective gloves.
6. All pumps are pretested with water before shipment. Remove head and dry thoroughly if you are pumping a material that will react with water, (e.g. sulfuric acid). Valve seats, ball checks, gaskets, and diaphragm should also be dried. Before placing feeder into service, extreme care should be taken to follow this procedure.
7. Arrows on the pump head and injection fitting indicate chemical flow. When properly installed, these arrows should be pointing upward.
8. When metering hazardous material DO NOT use plastic tubing. Strictly use proper rigid pipe. Consult supplier for special adaptors.
9. **Pump is NOT to be used to handle or meter flammable liquids or materials.**

10. Standard white polyethylene discharge tubing is not recommended for installations exposed to direct sunlight. Consult supplier for special black polyethylene tubing.
11. Manufacturer will not be held responsible for improper installation of pumps, or local plumbing conducted. All cautions are to be read thoroughly prior to hook-up and plumbing. For all installations a professional plumber should be consulted. Always adhere to local plumbing codes and requirements.
12. Note the maximum pressure rating of the metering pump. When used with pressurized systems, always be sure the pressure of the system does not exceed maximum pressure rating listed on the specification label.
13. Be sure to depressurize system prior to hook-up or disconnection of metering pump.

INSTALLATION, PIPING AND WIRING

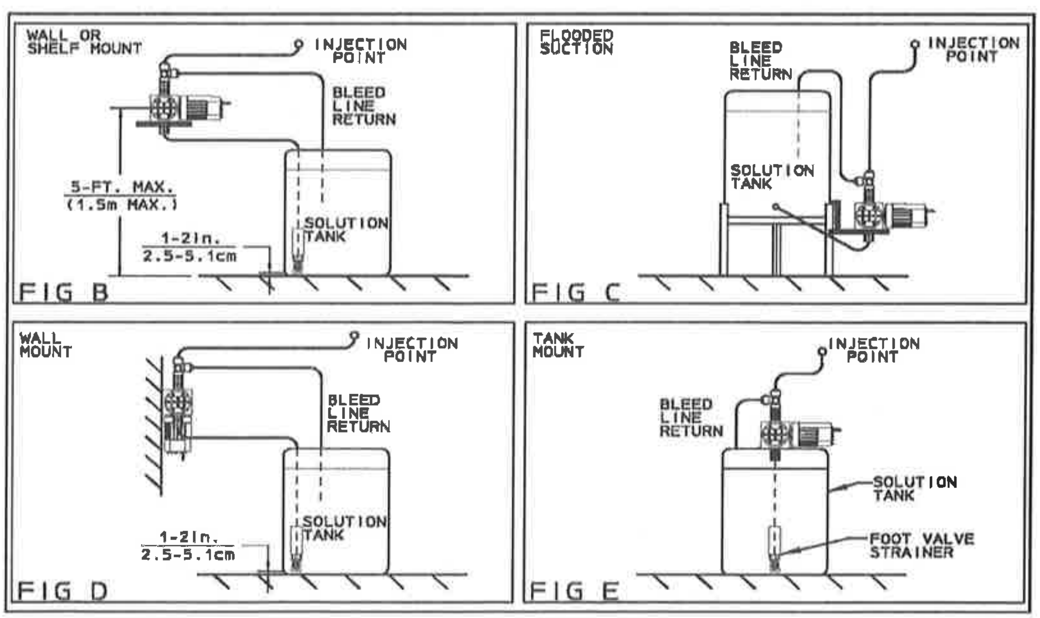
UNPACKING, ASSEMBLING AND MOUNTING:
The carton should contain:

- Metering Pump
- 4 ft. (1.21 m) Clear Flexible Suction Tubing
- 4 ft (1.21 m) Stiff White Return Tubing
- Feeder can be mounted on a wall shelf bracket (Figure B), tank stand platform (Figure C), directly on the wall (Figure D), or directly on the tank cover (Figure E).
- Bleed Valve Assembly
- Instructions
- Strainer Assembly w/Tube Weight
- Back Check Valve Assembly
- 8 ft (2.43 m) Stiff White Discharge Tubing (Optional black tubing for UV protection available from the factory)



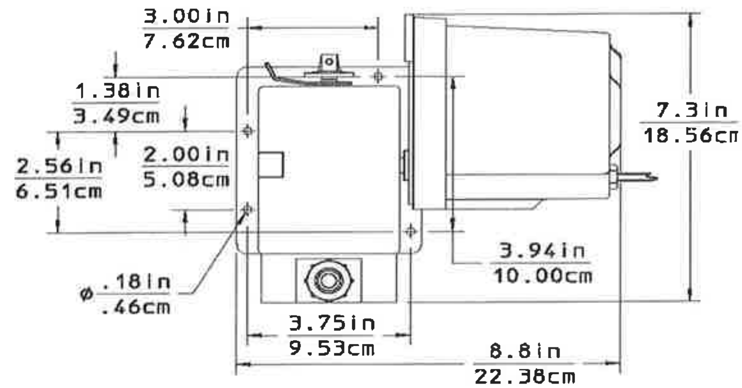
To mount the feeder directly on the wall, place the feeder base against the wall with the motor below the pumping head, remove four head mounting bolts, and turn head quarter turn so suction is in bottom position.

IMPORTANT: Injection point must be higher than top of solution tank to prohibit gravity feeding. Maximum head in meters is 70m/H_2O for Series 100 Model pumps and 42m/H_2O for Series 150 Model pumps.



NOTE: Make sure the arrow on the outside of the pump head is pointing upward. The pump must be positioned so that the plug is accessible.

Flooded suction mounting Fig. C (installing feeder at the base of tank on a platform) is the most trouble free type of installation. (Tank stands and platforms are available for all size feeders and tanks). The pump is secured on the platform, and then the clear suction tubing is attached to a bulkhead fitting assembly and the suction valve housing on the pump head. Since the suction tubing is always filled with solution, priming is accomplished much more quickly and the chance of losing prime on an installation where the feeder is used only a few hours a day, is greatly reduced. The feeder comes with a bleed valve assembly that attaches to the discharge valve in the pump head. The bleed valve allows you to manually prime the feeder and depressurize the discharge line without disconnecting the feeder from the tubing connections.



MOUNTING HOLE PATTERN

NOTE: To operate without bleed valve, replace bleed valve (item #49) and 0.38 in. (0.96 cm) -tubing size discharge valve housing (item # 42) with a 0.50 in. (1.27 cm) -tubing size discharge valve housing (item #42) and coupling nut (item #43). See page 12 (Wet End Assembly). Items #42 and #43 are available from factory.

Assemble tubing and fittings to the feeder (Fig. G).

⚠ CAUTION Do not force fittings, HAND TIGHTEN ONLY. Do not use additional sealants, such as pipe tape, on tubing fittings. Use additional sealants, such as pipe tape, on pipe fittings and tighten normally.

⚠ CAUTION If water is used to dissolve solid chemicals or create a dilute solution, the chemical tanks should be manually filled or an approved means must be used to prevent a cross connection between the chemical tank contents and the potable water line. Check local plumbing regulations.

CHEMICAL INJECTION:
Chemical injection into an open tank: The discharge tubing can be placed in an open tank with or without the injection valve assembly. Each feeder is shipped with a spring loaded back check injection valve. This assists in a positive seal on the discharge side of the pump head preventing back flow.

Pumps carrying the 'NSF' or the 'ETL Sanitation' (tested to NSF standard-50) approval are listed for swimming pools, spas, and hot tubs, and when proper materials are selected, are capable of handling but not limited to the following chemical solutions.

12 1/2% sodium hypochlorite 2% calcium hypochlorite 12% aluminum sulfate 10% hydrochloric acid 10% sodium hydroxide 5% sodium carbonate.

INSTALLATION INTO A WELL PUMP SYSTEM:
Make sure the voltage of the feeder matches the voltage of the well pump. Install the injection fitting into a tee which is installed into the water line going to the pressure tank. The end of the injection check valve should be in the main stream of the water line. A typical installation is shown in Figure H. **For installation of pump for operating swimming pools, pump is to be supplied by an isolating transformer or thru an "RCD" (residual current device).**

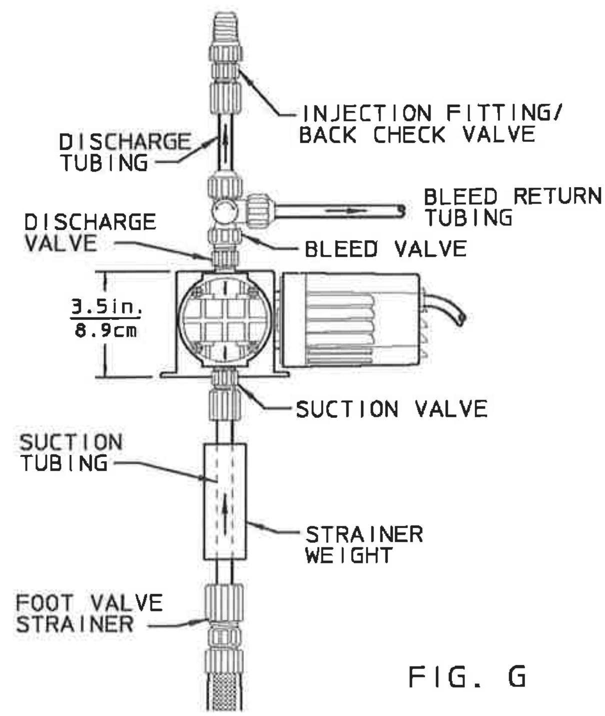


FIG. G

NOTE: It is recommended to install the injection assembly in a vertical position on the bottom side of the water line (Figure J).

This will insure proper sealing of the injection assembly check valve and prevent a back flow into the feeder's discharge line. Be sure arrow on injection fitting is pointing upward.

- **DOWN-THE-WELL INSTALLATION:**
Often it is desirable to provide chemical feed near the intake of the well pump for additional retention time and mixing of the chemicals. An additional length of discharge tubing will be required for this installation. Secure the end of the discharge tubing to the pump cylinder, drop pipe, or foot valve and lower it into the well. An anti-siphon valve must be installed on systems such as this where the discharge is lower than the feeder and the chemical storage tank.
Failure to install anti-siphon valve may allow siphoning to occur.

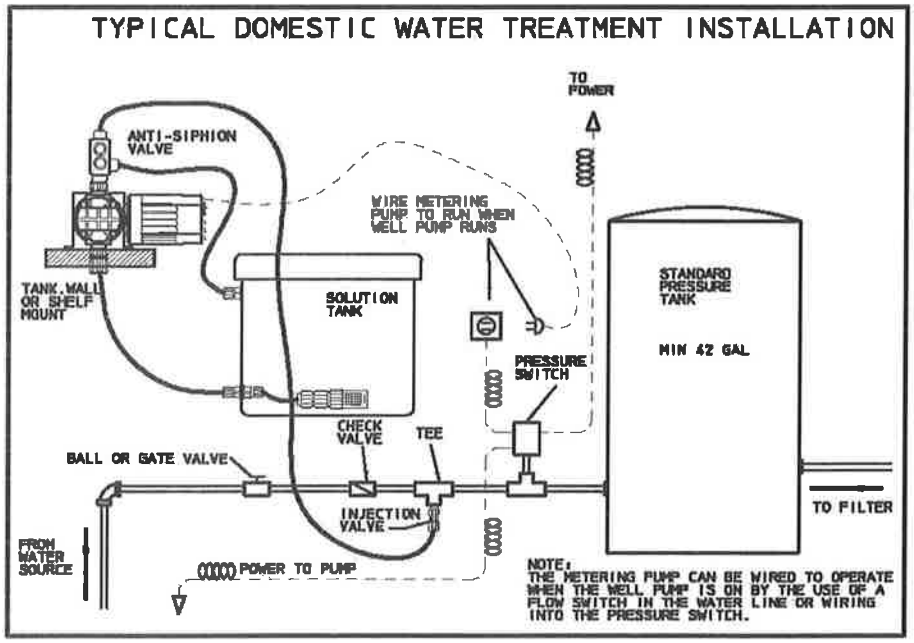


FIG. H

- **ANTI-SIPHON VALVE: (optional)**
Under any installation condition where the possibility of siphoning or suction may occur on the discharge side of the pump, install an anti-siphon valve on the discharge side of the feeder. The anti-siphon valve is not part of the standard package. This item can be furnished by your dealer at extra cost.

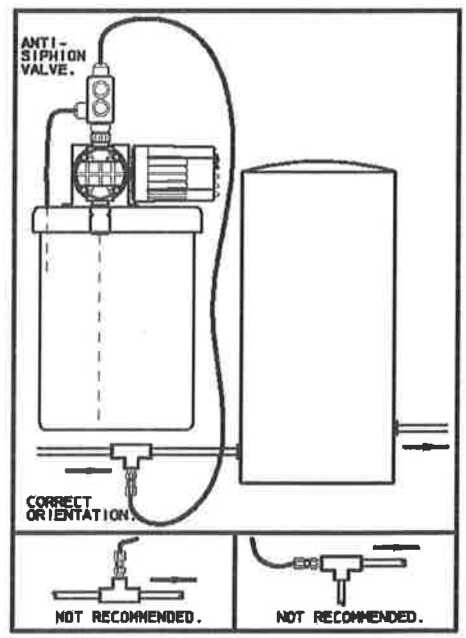
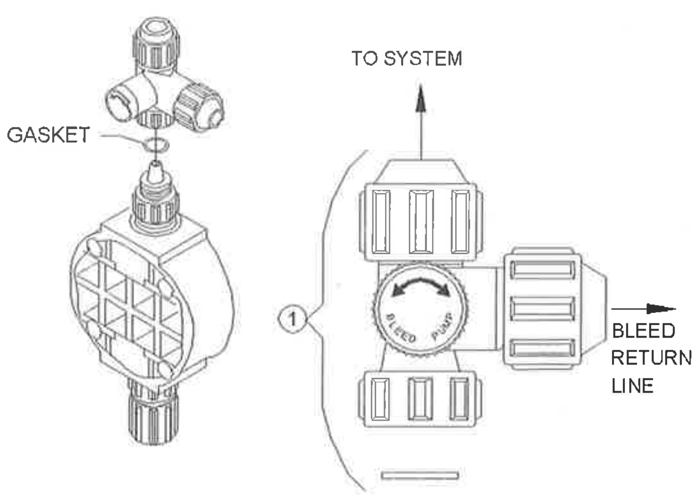


FIG. J

- **PRESSURE RELIEF VALVE: (optional)**
Series 100/150 chemical pumps are rated to pump against a line pressure up to 100 PSI (7 BAR). If the line pressure on an installation could fluctuate above 100 PSI (7 BAR), install a pressure relief valve on the discharge side of the pump head. Once the pressure reaches a certain level, the pre-set relief valve will return the solution being pumped back to the solution tank. This will prevent motor burnout or diaphragm rupture. The relief valve is not part of the standard package. This item can be furnished by your dealer at extra cost. Read relief valve instructions carefully before installing.

- **BLEED VALVE INSTALLATION: (optional)**
NOTE: After disconnecting power to the pump and taking necessary safety precautions regarding the chemical and system.
1. Remove the coupling nut and tubing from the discharge port of the pump.
2. Remove the valve housing from the discharge side of the pump head and replace it with the .38inch valve housing from the kit (this step is not required if the pump is already fitted for .38inch tubing.
3. Install the TFE gasket (ChemTech) over the discharge fitting.
4. Install the bleed valve assembly over the discharge fitting and gasket. (ChemTech)



5. Install the bypass tubing from the kit into the bypass port of the bleed valve and hand tighten the coupling nut. Bypass tubing should be connected to return bypassed liquid back to the solution tank.
6. Install the discharge tubing into the discharge port of the bleed valve and hand tightens the coupling nut.
7. Return the system to operating conditions and reconnect the power to the pump.
   The pump is now ready for priming and operation. Always use caution and check for leaks at newly assembled connections.

Air Bleed Operation:
1. While pump is running, turn the bleed valve knob counter clockwise.
2. Run with valve open until a solid stream of fluid comes out of the bypass tubing (.38inch tubing supplied with valve)
3. Close air bleed valve by turning the bleed valve knob clockwise.

- **HAND TIGHTEN FITTINGS:**

When connecting tubing to suction and discharge fittings, the coupling nuts should be tightened hand tight only. Excessive tightening can cause cracks in pump head.

- **POINT OF INJECTION:**

Pipe corrosion can result if dillution at the injection point does not occur rapidly. This problem is easily prevented by observing this simple rule: install injection fitting so that the end is in the flow stream of the line being treated. **NOTE:** Extended injection assemblies are available for large water lines. Consult your dealer.

- **COMMON ERRORS IN THE INJECTION OF CHEMICALS:**

Do not insert the injection fitting into a pipe stub in the tee. A full strength solution will often cause corrosion or scale in the pipe stub when it is not in the flowing stream (Figure J). The maximum lift of the chemical feeder is five feet. Be sure not to exceed this height. **It is very important that the arrow on the fittings and the pump head point vertically upward in order to prevent backflow.** Arrows indicate the proper flow of the chemical.

POWER

The standard chemical feeder is available in115 volt 60 cycle single phase. 230 volt 60 cycle and 230 volt 50 cycle single phase can also be made available upon request.

⚠ CAUTION **Be sure the voltage of the feeder matches the power supply.** (Figure M)

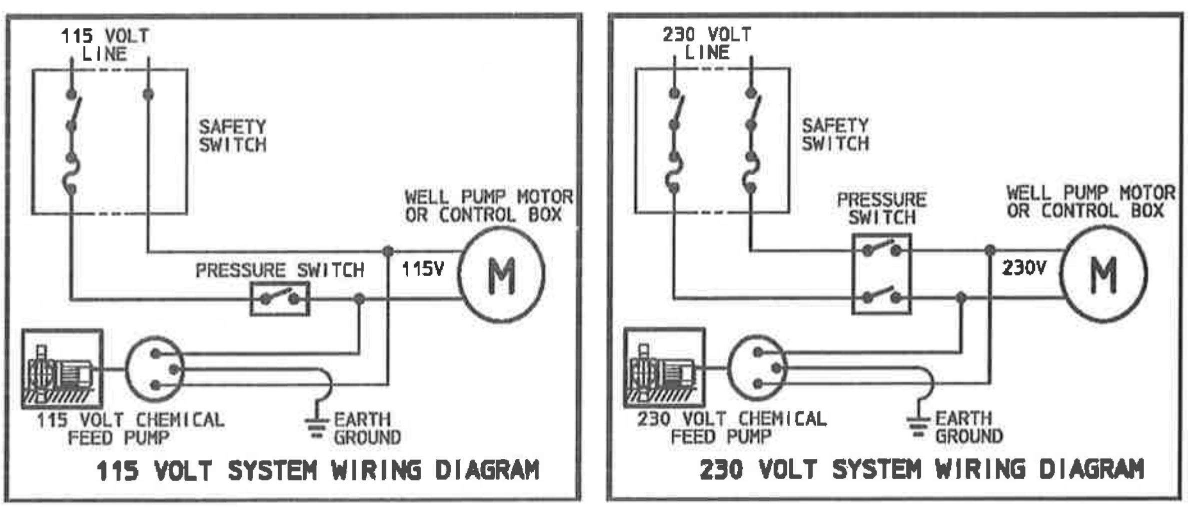


Figure M

When working on or around metering pump installation, protective gloves and safety glasses should be worn at all times.

▪ PRIMING

⚠ CAUTION **All pumps are tested with water (e.g. sulfuric acid, polymer) the pump head should be removed and dried thoroughly along with the diaphragm and valve seats.**

If the discharge line is connected directly to a pressurized system it should be temporarily bypassed during priming of the pump. This pump is equipped with a bleed valve to simplify this operation by allowing easy bypass of the discharge fluid.

All air must be purged from the pump head before the pump will pump against pressure. Turn on the power to the pump. Loosen the locking lever by turning it counter-clockwise and turn the output adjusting knob counter-clockwise to full capacity, (one full turn only) then tighten the locking lever by turning clockwise to a hand tight position. Solution should be primed to the head within a few minutes. (Refer to Figure K)

Air Bleed Operation: A) While pump is running, turn adjustment screw counterclockwise. B) Run with valve open until a solid stream of fluid comes out of the bypass tubing (0.25 in (0.63 cm) ID x 0.38 in (0.96 cm) OD) supplied with valve, no air bubbles. C) Close air bleed valve by turning adjustment screw clockwise.

NOTE: The feeder is adjustable only while running; never force the output adjustment knob. Do not turn the adjustment knob while the pump is stopped. If the solution hasn't reached the head in a few minutes, disconnect power to the pump, make sure the system is depressurized, remove the discharge tubing and discharge fitting and dampen the discharge valve area (ball check and valve seats) with a few drops of solution being fed by the pump. For safety, use protective gloves and safety glasses and a proper container to hold chemical. Replace the fitting and tubing and restart the pump.

Turn the power on once more and adjust the pump to the proper rate, using the locking lever as before.

⚠ CAUTION ***When working on or around metering pump installation, protective gloves and safety glasses should be worn at all times.***

⚠ CAUTION **Check calibration of the pump before leaving the installation site. A test for chemical residual in the treated water is the best indication of the correct pump setting.**

▪ MAINTENANCE:

▪ SCALE: GASKETS AND CHECK VALVES

When checking the metering pump or providing routine maintenance, replace all valve seats or ball checks if any of them show any wear or deterioration. (Valve seats should be checked approximately every 4-6 months depending upon the application.) Repeated deterioration of valve seats and other rubber or plastic parts within a few months period usually indicates another material should be used for the defective part. Contact your supplier or see the parts list for parts affected for possible alternate materials.

▪ OUTSIDE INSTALLATION:

In many areas where freezing conditions are not a problem it is common to install a metering pump outside. Adequate protection should be provided to keep the pump from being exposed to direct sunlight or rain. Any simple covering adequately ventilated will afford the necessary protection from weather. **NOTE:** When discharge tubing is exposed to direct sunlight, black polyethylene tubing should be used in lieu of the stiff white translucent tubing supplied with each pump.

▪ SOLUTION TANK:

Check the solution tank for settling of chemicals. If there is sludge on the bottom of the solution tank, clean the strainer, the foot valve, and the solution tank. Installing the foot valve a few inches above the bottom of the tank will prevent future clogging. **NOTE: If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (calcium hydroxide), mixers are readily available in different motor configurations and mountings.**

▪ OUTPUT ADJUSTING KNOB:

Sometimes the output adjusting knob can move on its shaft and cause a false output indication. This can happen if the knob set-screw slips or if the unit is disassembled for any reason. The unit can be reset to "0" as follows:

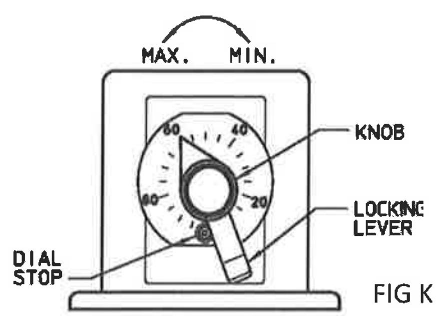


FIG K

1. Remove the dial stop.
2. With the pump running, loosen the locking lever and turn the adjusting knob counter-clockwise until it is "loose" to touch.
3. SLOWLY re-screw the knob clockwise, using very light finger pressure. It will soon start to advance in pulses as the internal cam comes in and out of contact.
4. When light finger pressure will no longer allow movement of the knob between cam contacts, grasp the knob securely and tighten the locking lever (turning clockwise) making sure that the knob does not move. To check for zero point, turn on pump. There should be no liquid coming out of discharge fitting.
5. Replace dial stop.

6. If the pointer is not at "0", loosen the set-screw on the knob (use a .078 in Hex key), and turn pointer to "0", then retighten the set-screw while holding the knob in place.

7. A setting of "0" will now give zero output. One full revolution of the knob counter clockwise will give maximum output. The knob should never be turned more than one full revolution.

SERVICING AND REPAIRS

CAUTION REPLACEMENT OF PUMP HEAD ASSEMBLY OR DIAPHRAGM:

Before performing any repairs on Series 100/150 chemical feeders, be sure to disconnect all electrical connections and relieve pressure from suction/discharge tubing.

The Series 100/150 feeder was designed so that servicing can be quick and simple. Proper part replacement procedures are described below.

NOTE: Use protective gloves and safety glasses when working on or around chemical feeder.

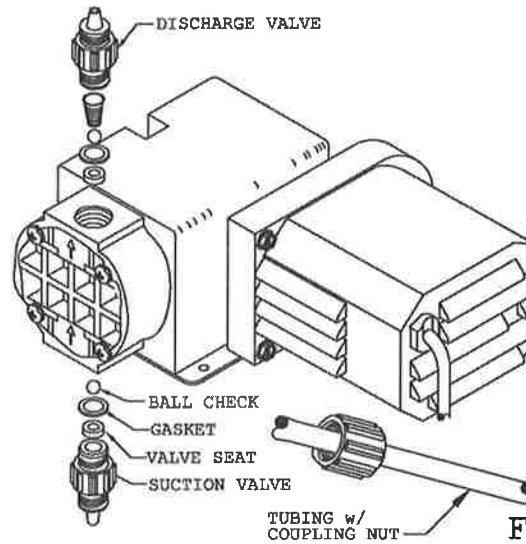


FIG. N

1. Disconnect the tubing. Remove the suction valve and discharge valve being careful not to lose the ball checks and any other small parts. (Figure N)
2. Remove the four screws from the face of the head and remove the head.
3. Remove the diaphragm by inserting one or two of the head bolts into the holes of the diaphragm and turning counter-clockwise. (Figure O)
4. A new pump head or diaphragm should be installed if either is broken or cracked (see parts list at the end of this manual). The new pump head can be installed by going through the above steps in reverse.
5. Be sure the drive bracket assembly is in the **fully retracted position** when installing the new diaphragm. Install the new diaphragm by screwing it in hand tight, then, back off one-fourth turn or until screw holes are lined up.
6. Replace the head and the head screws, being certain the discharge fitting is up. NOTE: Arrow on outside of pump head should be in vertical position pointing upward. Tighten the head screws evenly and carefully to prevent cracking the head.
7. Replace the suction and discharge fittings making sure all gaskets and valves are fitted properly. Do not use pipe tape or other sealants. **HAND TIGHTEN ONLY.** Restart the system as in the start up procedures (INSTALLATION).

BALL CHECKS AND VALVE SEAT REPLACEMENT:

The following procedure is the same for any of the four valves.

Make sure all electrical connections are disconnected and pressure valves off.

NOTE: Use protective gloves and safety glasses while replacing parts.

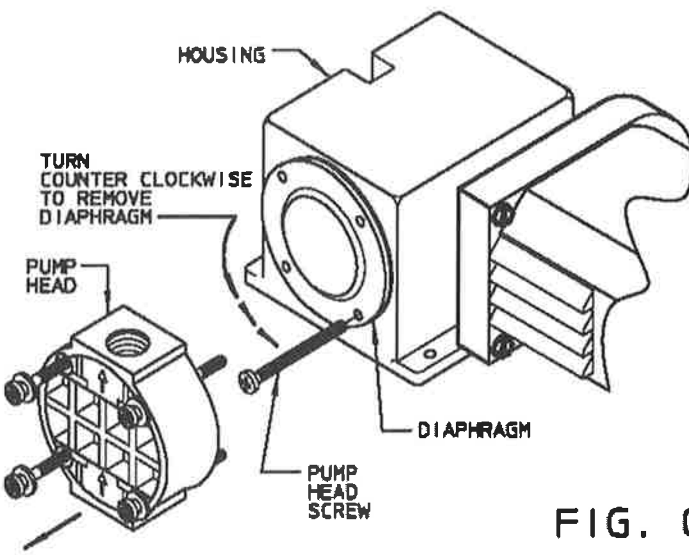


FIG. O

1. Unscrew compression nut and remove tubing.
2. Unscrew check valve body from pump head, foot valve, or injection fitting.
3. Remove all seats, ball checks, and gaskets and replace.
4. Replace the check valve body so fitting makes contact with the gasket and the pump head, foot valve or injection fitting, whichever the case may be. **HAND TIGHTEN FITTINGS ONLY.** Do not use pipe tape or other sealants on these threads.
5. Re-install the tubing and tighten coupling nut **HAND TIGHT.**
6. Restart the system as in the INSTALLATION PROCEDURES.

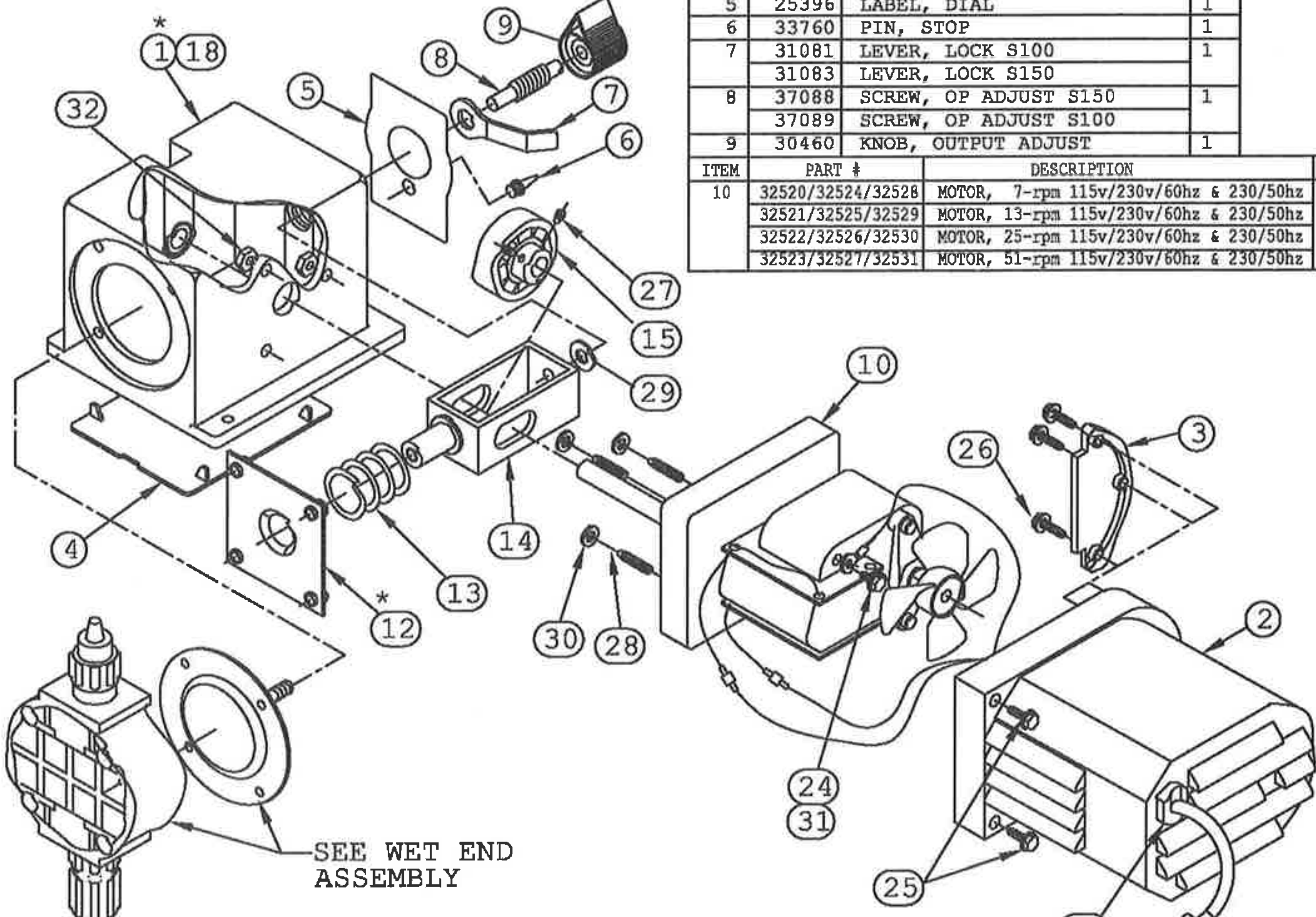
TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
LOSS OF CHEMICAL RESIDUAL	1. Pump setting too low. 2. Scale at injection point 3. Solution container allowed to run dry	1. Adjust to higher setting (feeder must be operating during the stroke length adjustment). 2. Clean injection parts with 8% muriatic acid or undiluted vinegar. 3. Refill the tank with solution and prime. See Start-Up Section
TOO MUCH CHEMICAL	1. Pump setting too high. 2. Chemical in solution tank too rich. 3. Siphoning of chemical into well or main line	1. Lower pump setting (pump must be operating to adjust the dial). 2. Dilute chemical solution. NOTE: For chemical that reacts with water, it may be necessary to purchase a more dilute grade of chemical direct from chemical supplier. 3. Test for suction or vacuum at the injection point. If suction exists, install an anti-siphon valve. See Figure G.
LEAKAGE AROUND TUBING CONNECTIONS	1. Worn tube ends 2. Chemical attack	1. Cut off end of tubing (about 1") and then slip on as before or replace suction valve housing and compression fitting to prevent leakage. 2. Consult your chemical supplier for compatible materials.
FAILURE TO PUMP OR FEED	1. Leak in suction side of pump. 2. Valve seats not sealing. 3. Low setting on pump. 4. Low solution level. 5. Diaphragm ruptured. 6. Pump head cracked or broken. 7. Pump head contains air or chlorine gas.	1. Examine suction tubing. If worn at the end, cut approximately an inch off and replace or replace valve body and coupling nut. 2. Clean valve seats if dirty or replace with proper material if deterioration is noted. 3. When pumping against pressure, the dial should be set above 40% maximum rated capacity for a reliable feed rate. 4. Solution must be above foot valve. 5. Replace diaphragm as shown in "Service" Section. Check for pressure above 100 PSI (7 BAR) at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head. 6. Replace pump head as shown in "Service" Section, Do not use pipe tape or other sealants. Make sure fittings hand tight only. Using pliers or wrench can crack pump head. Also, chemical incompatibility can cause cracking and subsequent leakage. 7. While pump is running, turn bleed valve adjustment screw counter-clockwise until air is purged. Close bleed valve.
PUMP LOSES PRIME	1. Dirty check valve. 2. Ball checks not seating or not sealing properly. 3. Solution container allowed to run dry	1. Remove and replace or clean off any scale or sediment. 2. Check seat and ball checks for chips, clean gently. If deformity or deterioration is noted, replace part with proper material. Chemical crystallization can hold check valves open, therefore the valves must be disassembled and cleaned. Be sure to replace all parts as shown in the Parts Diagram (at the end of the manual). 3. Refill the tank with solution and prime.
LEAKAGE AT FITTING	1. Loose fittings 2. Broken or twisted gasket 3. Chemical attack	1. All fittings can be hand tightened to prevent leakage. Clean off chemicals which have spilled on pump. 2. Check gaskets and replace if broken or damaged. 3. Consult your chemical supplier for compatible materials.
PUMP WILL NOT PRIME	1. Too much pressure at discharge 2. Check valves not sealing 3. Output dial not set at maximum	1. Open bleed valve and circulate fluid until all air is purged from pump head assembly. Close bleed valve. 2. Disassemble, loosen, clean and check for deterioration or swelling. Reassemble and wet the valve assembly, then prime. See INSTALLATION Section. 3. Always prime pump with output dial set at maximum rated capacity.
ANTI-SIPHON VALVE MALFUNCTION	1. Scale or particles have plugged diaphragm 2. Ruptured valves	1. Remove, clean and reassemble, being careful not to wrinkle the diaphragm. Check sequence and position of parts to be sure reassembly is correct. 2. Consult your distributor for replacement.
PUMP MOTOR STALLS	1. Pumping against excessive pressure 2. Low voltage to pump	1. Test pressure to determine if it exceeds pump specifications. If so, consult your distributor. 2. Make sure voltage of power source matches the voltage on the pump specifications label. If not transformers are available.
MOTOR RUNNING VERY HOT	1. Low voltage. 2. If using a step-down transformer, it may be undersized for the pump	1. Power supply voltage should match voltage on pump specification label. 2. Check the transformer to be sure it has at least 100 watts capacity.

SERIES 100/150 DRIVE ASSEMBLY

ITEM	PART #	DESCRIPTION	QTY
* 1	J30496	HOUSING, S100 3,7,15,30-gpd	1
	J30497	HOUSING, S100 24-gpd	
	J30498	HOUSING, S150 68, 100-gpd	
2	25180	COVER, MOTOR	1
	J25212	COVER, MOTOR CE(EURO)	
3	34405	PLATE, COVER MOTOR	1
4	J34449	PLATE, BOTTOM HOUSING	1
5	25396	LABEL, DIAL	1
6	33760	PIN, STOP	1
7	31081	LEVER, LOCK S100	1
	31083	LEVER, LOCK S150	
8	37088	SCREW, OP ADJUST S150	1
	37089	SCREW, OP ADJUST S100	
9	30460	KNOB, OUTPUT ADJUST	1

ITEM	PART #	DESCRIPTION	QTY
10	32520/32524/32528	MOTOR, 7-rpm 115v/230v/60hz & 230/50hz	1
	32521/32525/32529	MOTOR, 13-rpm 115v/230v/60hz & 230/50hz	
	32522/32526/32530	MOTOR, 25-rpm 115v/230v/60hz & 230/50hz	
	32523/32527/32531	MOTOR, 51-rpm 115v/230v/60hz & 230/50hz	



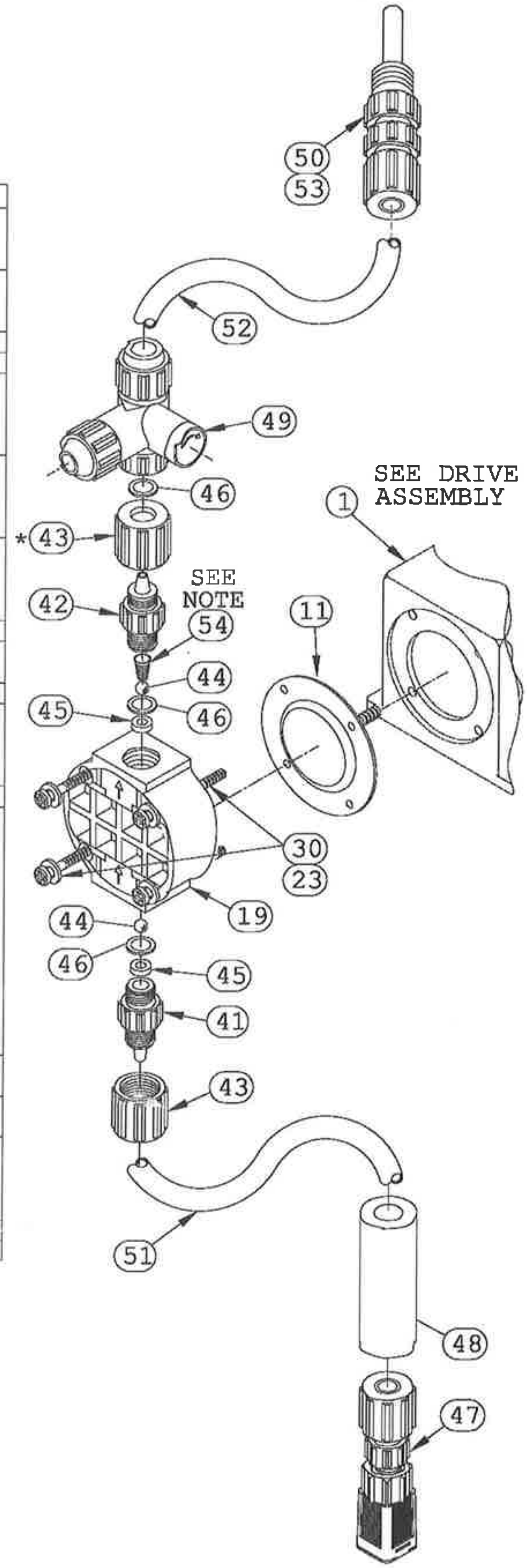
ITEM	PART #	DESCRIPTION	QTY
*12	J34379	BACKING PLATE AS'Y	1
13	38980	SPRING, DIAPHRAGM RETURN	1
14	21829	BRACKET AS'Y, DRIVE	1
15	22255	CAM/BEARING AS'Y,S100 3,7,15,30-gpd	1
	22256	CAM/BEARING AS'Y, S100 24-gpd	
	22257	CAM/BEARING AS'Y, S150 68, 100-gpd	
*18	20850	BEARING, NEEDLE	1
20	24820	CORD, 6ft. 115vAC	1
	24821	CORD, 6ft. 230vAC	
	J24829	CORD, 6ft. 230vAC/CE(EURO)	
22	L9900700-000	CONNECTOR, STRAIN RELIEF	1
24	37031	SCREW, #8-AB x .38in.-lg. H.W.HD	1
25	37032	SCREW, #8-B x .44in.-lg. H.W.HD	2
26	J37033	SCREW, #8-B x .50in.-lg. H.W.HD	3
27	37047	SCREW, SET 10-32 x .25in.-lg.	2
28	37049	SCREW, SET 10-32 x .75in.-lg.	3
29	42041	WASHER(STL), .26in.-I.D.	1
30	J42020	WASHER(STL), #10	3
31	42045	WASHER(STL), #8 EXT. RH LOCK	1
32	L9800600-STL	NUT, #10-32 HEX	3

* = ITEMS INCLUDED IN HOUSING ITEM #1.

SERIES 100/150 WETEND ASSEMBLY

ITEM	PART #	DESCRIPTION	QTY
11	25704	DIAPHRAGM(HYP) AS'Y	1
	25706	DIAPHRAGM(VIT) AS'Y	
	25707	DIAPHRAGM(TFE) AS'Y	
19	28800	HEAD(SAN-ACRYLIC), PUMP	1
	J28801	HEAD(PVC), PUMP	
	28803	HEAD(FPP), PUMP	
23	J37005	SCREW(SST), #10-24 x 2in.-lg. PHP	4
30	J42020	WASHER(STL), #10-FLAT	4
41	J41548	BODY(PVC), SUCTION VALVE Ø.5in.-TUBE	1
	41549	BODY(FPP), SUCTION VALVE Ø.5in.-TUBE	
	41551	BODY(PVC), SUCTION VALVE Ø.38in.-TUBE	
	41552	BODY(FPP), SUCTION VALVE Ø.38in.-TUBE	
42	J41540	BODY(PVC), DISCHARGE VALVE Ø.5in.-TUBE	1
	41541	BODY(FPP), DISCHARGE VALVE Ø.5in.-TUBE	
	41543	BODY(PVC), DISCHARGE VALVE Ø.38in.-TUBE	
	41544	BODY(FPP), DISCHARGE VALVE Ø.38in.-TUBE	
43*	J24960	NUT(PVC), COUPLING Ø.50in.-TUBE STD.	2
	24961	NUT(FPP), COUPLING Ø.50in.-TUBE	
	24963	NUT(PVC), COUPLING Ø.38in.-TUBE	
	24964	NUT(FPP), COUPLING Ø.38in.-TUBE	
44	J20560	BALL(CER), Inq command	
45	J37440	SEAT(HYP), VALVE	2
	J37442	SEAT(VIT), VALVE	
46	J27903	GASKET(TFE)	2-3
47	J60717	STRAINER AS'Y/FOOT VALVE(PVDF/HYP/C/Ø.38	1
	J60718	STRAINER AS'Y/FOOT VALVE(PVDF/VTN/C/Ø.38	
	J60729	STRAINER AS'Y/FOOT VALVE(PVDF/HYP/C/Ø.50	
	J60730	STRAINER AS'Y/FOOT VALVE(PVDF/VTN/C/Ø.50	
48	L9906700-000	WEIGHT(CER), STRAINER	1
49	J30507	KIT, BLEED VALVE PVC/HYP/Ø.38in.-TUBE	1
	J30509	KIT, BLEED VALVE PVC/VTN/ "	
	J30510	KIT, BLEED VALVE PVC/TFE/ "	
	J30511	KIT, BLEED VALVE FPP/HYP/ "	
	J30513	KIT, BLEED VALVE FPP/VTN/ "	
	J30514	KIT, BLEED VALVE FPP/TFE/ "	
	J30515	KIT, BLEED VALVE PVC/HYP/Ø.50in.-TUBE	
	J30517	KIT, BLEED VALVE PVC/VTN/ "	
	J30518	KIT, BLEED VALVE PVC/TFE/ "	
	J30519	KIT, BLEED VALVE FPP/HYP/ "	
	J30521	KIT, BLEED VALVE FPP/VTN/ "	
	J30522	KIT, BLEED VALVE FPP/TFE/ "	
50	41693	INJECTION FITTING PVC/HYP/C Ø.38in.-T	1
	J41694	INJECTION FITTING PVC/HYP/C Ø.50in.-T	
51	00006	SUCTION TUBING(PVC) Ø.44in.-O.D.	4-ft.
	00007	SUCTION TUBING(PVC) Ø.38in.-O.D.	
52	00008	DISCHARGE TUBING(PE-WHT) Ø.50in.-O.D.	8-ft.
	00009	DISCHARGE TUBING(PE-BLK) Ø.50in.-O.D.	
	00010	DISCHARGE TUBING(PE-WHT) Ø.38in.-O.D.	
	00011	DISCHARGE TUBING(PE-BLK) Ø.38in.-O.D.	
53	J39010	SPRING, INJECTION BACKCHECK(not shown)	1
54	J38985	SPRING(HCO),HEAVY S100/2/3/INJ(SEE NOTE)	1

* NOT USED WITH BLEED VALVE.
(NOTE: X003 AND X007 ONLY)



BALDOR

BALDOR • RELIANCE

Part Information Packet

BALDOR HAYWARD

09R044X763G1

20HP,3520RPM,3PH,60HZ,256TC,0940M,TEFC,F

Part Detail

Revision:	M	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	0940M	Elec. Spec:	09WGX763	CD Diagram:	
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	09R044	Layout:	
Frame:	256TC	Mounting:	F1	Poles:	02	Created Date:	
Base:	N	Rotation:	R	Insulation:	F	Eff. Date:	04-27-2009
Leads:	9#12	Literature:		Elec. Diagram:		Replaced By:	

Nameplate NP1259L

CAT.NO.							
SPEC.	09R044X763G1						
HP	20						
VOLTS	230/460						
AMP	45/22.5						
RPM	3520						
FRAME	256TC	HZ	60	PH	3		
SER.F.	1.15	CODE	H	DES	B	CL	F
NEMA-NOM-EFF	92.4	PF	90				
RATING	40C AMB-CONT						
CC		USABLE AT 208V	49				
DE	6309	ODE	6208				
ENCL	TEFC	SN					

Parts List

Part Number	Description	Quantity
SA086051	SA 09R044X763G1	1.000 EA
RA079119	RA 09R044X763G1	1.000 EA
S/P107-000-005	SUPER-E PROC'S(254/6 FR.) ZK PLANT - POL	1.000 EA
HW1002A63	WASHER, 5/8 HI-COLLAR SPRLCKWASHER	1.000 EA
09CB3000SP	CONDUIT BOX CAST	1.000 EA
09GS1000SP	GASKET-CONDUIT BOX, 1/16 THICK LEXIDE	1.000 EA
10XN2520K12	1/4-20 X.75 GRD 5	2.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	2.000 EA
WD1000B17	LUGSDIRECT WIRE LUG, CAT # S6	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
09EP1100A14SP	ENDPLATE, MACH	1.000 EA
HW5100A08	W3118-035 WVY WSHR (WB)	1.000 EA
10XN2520K28	1/4-20 X 1.75" HX HD SCRWGRADE 5, ZINC P	2.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	2.000 EA
09EP1300A12	ENDPLATE, MACH	1.000 EA
10XN2520K36	1/4-20 X 2.25" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HA3113A02	THRUBOLT 3/8-16X16.625	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	8.000 EA
XY3816A12	3/8-16 FINISHED NUT	4.000 EA
09FH1000A03	SPL FAN HOUSING 309 FRAME	1.000 EA
HA2081A05	SPACER TUBE, 309 FAN HSG, 2.00 LONG	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
XY3816A12	3/8-16 FINISHED NUT	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
09FH1500A01	DRIP COVER, MACH 309 FRAME	1.000 EA
10XN2520K30	STD.25X20 THD HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1000A25	1/4 SAE FLAT WASHER (FS)	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
09CB3500SP	CONDUIT BOX LID, CAST	1.000 EA
09GS1001SP	GASKET-CONDUIT BOX LID, 1/16 THICK LEXID	1.000 EA
51XW2520A12	.25-20 X .75, TAPTITE II, HEX WSHR SLTD	2.000 EA
HW4600B44SP	V-RING SLINGER 1.500 X 2.290 X 0.280	1.000 EA
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
PK6014	STEEL STRAP FOR 309-310 BASELESS MOTORS	3.000 EA
10XN3118K12	5/16-18 X .75 GRADE 5, ZINC PLATED	3.000 EA
HW4500A05	1669B ALEM/UNIV860 GR FTG X	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON	0.080 LB
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
37FN3002C02	EXFN, PLASTIC, 6.00 OD, 1.500 ID	1.000 EA
HW2500A25	WOODRUFF KEY USA #1008 #BLOW CARBON STEE	1.000 EA
51XB1214A20	12-14X1.25 HXWSSLD SERTYB	1.000 EA
HW4500A03	GREASE FITTING, .125 NPT 1610(ALEMITE) 8	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA

Parts List (continued)

Part Number	Description	Quantity
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY	0.050 GA
85XU0407A04	#4-7 X 1/4 DRIVE PIN	2.000 EA
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	4.000 EA
LC0005E02	SPL CONN.DIA./WARN.LABEL(LC0005/LB1119)	1.000 EA
NP1259L	SUPER E, ALUM, UL CSA CC, W/O THERMAL,	1.000 EA
40PA1005	PACKAGING GROUP, 09 STD	1.000 EA

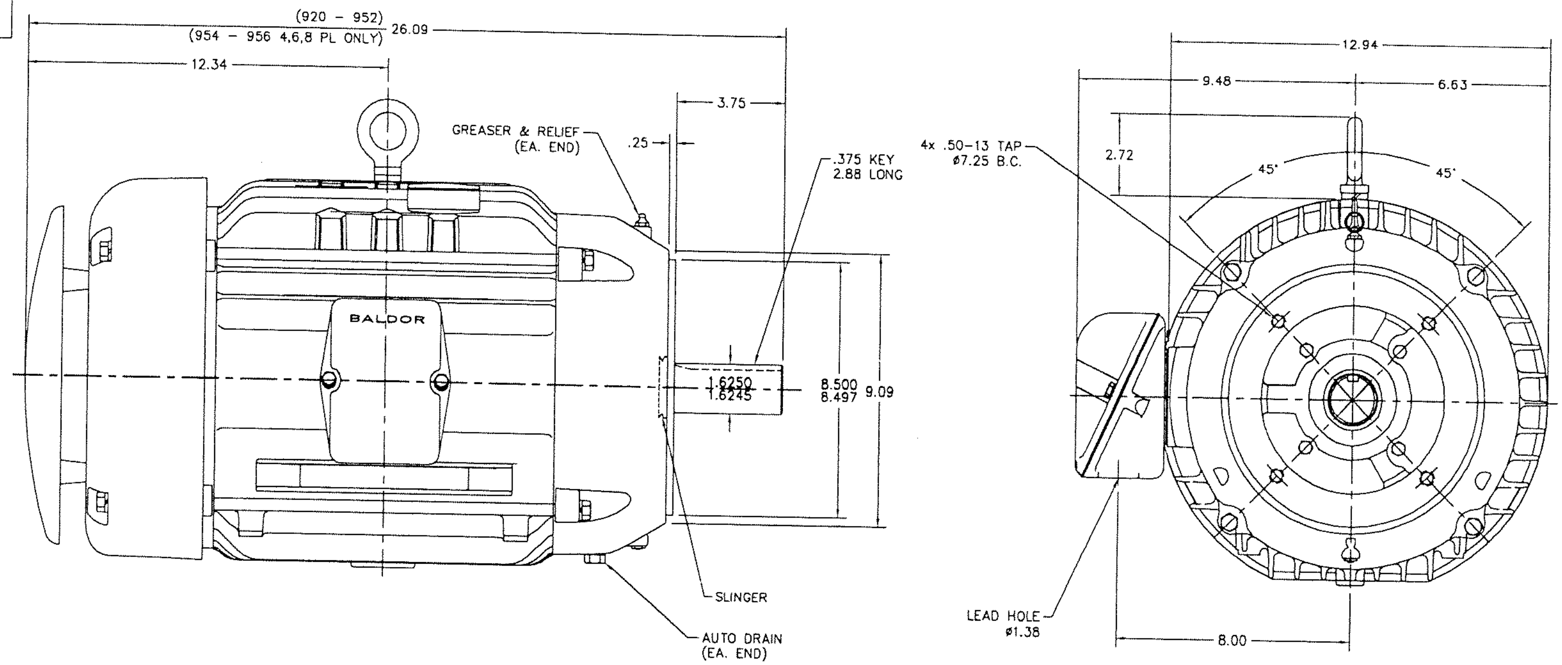
Performance Data at 460V, 60Hz, 20.0HP (Typical performance - Not guaranteed values)

General Characteristics

Full Load Torque:	29.8 LB-FT	Start Configuration:	DOL
No-Load Current:	6.79 Amps	Break-Down Torque:	132.0 LB-FT
Line-line Res. @ 25°C.:	0.411 Ohms A Ph / 0.0 Ohms B Ph	Pull-Up Torque:	33.2 LB-FT
Temp. Rise @ Rated Load:	73 C	Locked-Rotor Torque:	50.8 LB-FT
Temp. Rise @ S.F. Load:	98 C	Starting Current:	165.7 Amps

Load Characteristics

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor:	59.0	79.0	86.0	90.0	91.0	91.0	90.0
Efficiency:	89.0	92.5	93.0	92.5	91.7	90.5	92.1
Speed:	3582.0	3563.0	3543.0	3523.0	3501.0	3476.0	3510.0
Line Amperes:	8.95	12.78	17.5	22.59	28.14	34.22	25.89

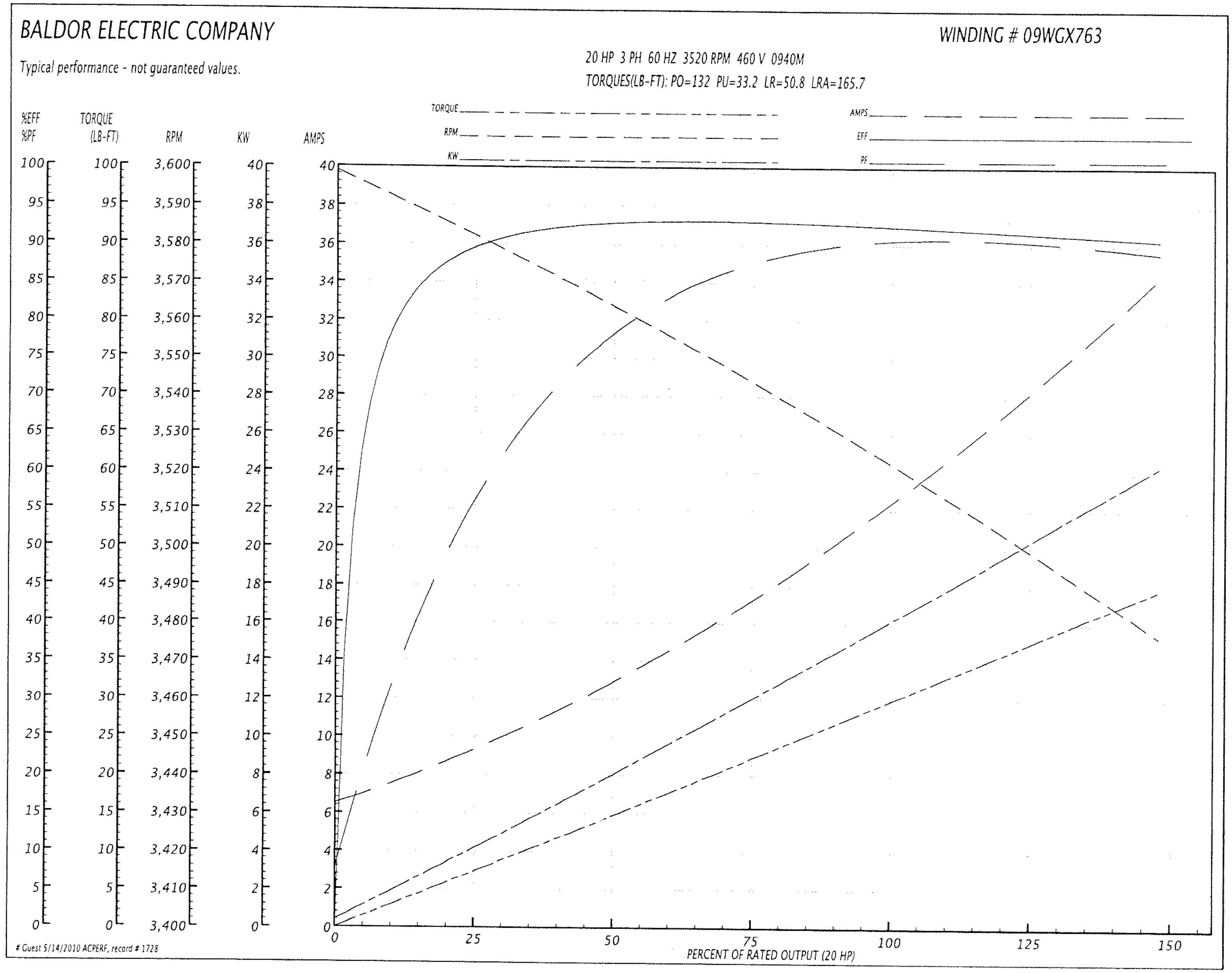


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

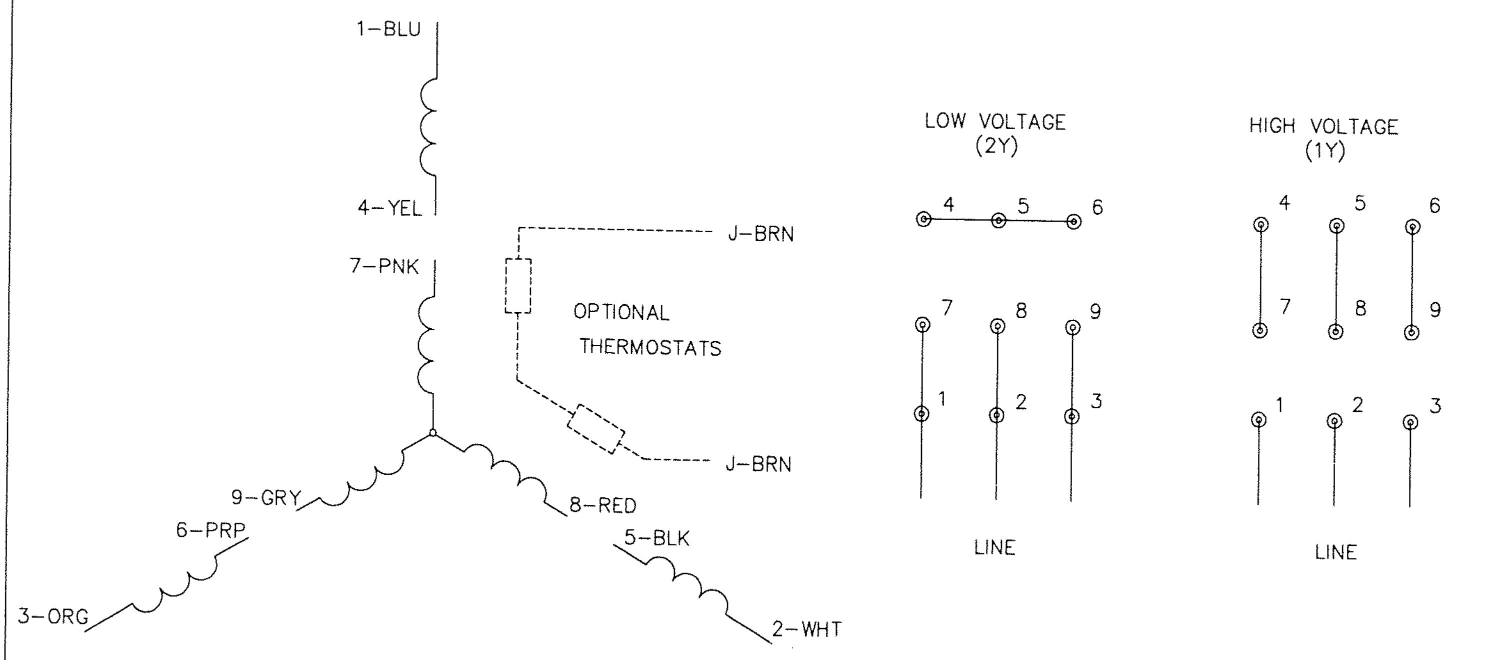
REV. DESC: REPLACE HA2081A01 WITH HA2081A05			Baldor • Dodge • Reliance
REV. LTR: E	VERSION: 03	TDR: 000000463373	
FILE: \AAA\00038\769	REVISED: 08:28:02 04/28/2008	BY: ENCARCO	VERT TEFC 254-6TC W/DRIP COVER
MTL: –			

09LYR044

Performance Graph at 460V, 60Hz, 20.0HP Typical performance - Not guaranteed values



CD0005



NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS				BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435	
CD0005		FILE: AAA00005140	MDL: –	3PH, DV, 9 LEADS
		MTL: –		

CD0005

BALDOR
A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Product Information Packet

VL3506

.75HP,3450RPM,1PH,60HZ,56C,3424L,TEFC,F1

Part Detail

Revision:	T	Status:	PRD/A	Change #:		Proprietary:	No
Type:	AC	Prod. Type:	3424L	Elec. Spec:	34WG3405	CD Diagram:	
Enclosure:	TEFC	Mfg Plant:		Mech. Spec:	34K043	Layout:	
Frame:	56C	Mounting:	F1	Poles:	02	Created Date:	
Base:	N	Rotation:	R	Insulation:	B	Eff. Date:	06-17-2011
Leads:	6#18	Literature:		Elec. Diagram:		Replaced By:	

Nameplate NP1256L

CAT.NO.	VL3506						
SPEC.	34K43-3405						
HP	.75						
VOLTS	115/230						
AMP	9.6/4.8						
RPM	3450						
FRAME	56C	HZ	60	PH	1		
SER.F.	1.25	CODE	K	DES	N	CLASS	B
NEMA-NOM-EFF	66	PF	74				
RATING	40C AMB-CONT						
CC		USABLE AT 208V	6.1				
DE	6203	ODE	6203				
ENCL	TEFC	SN					
	SFA 11.6/5.8						

Parts List

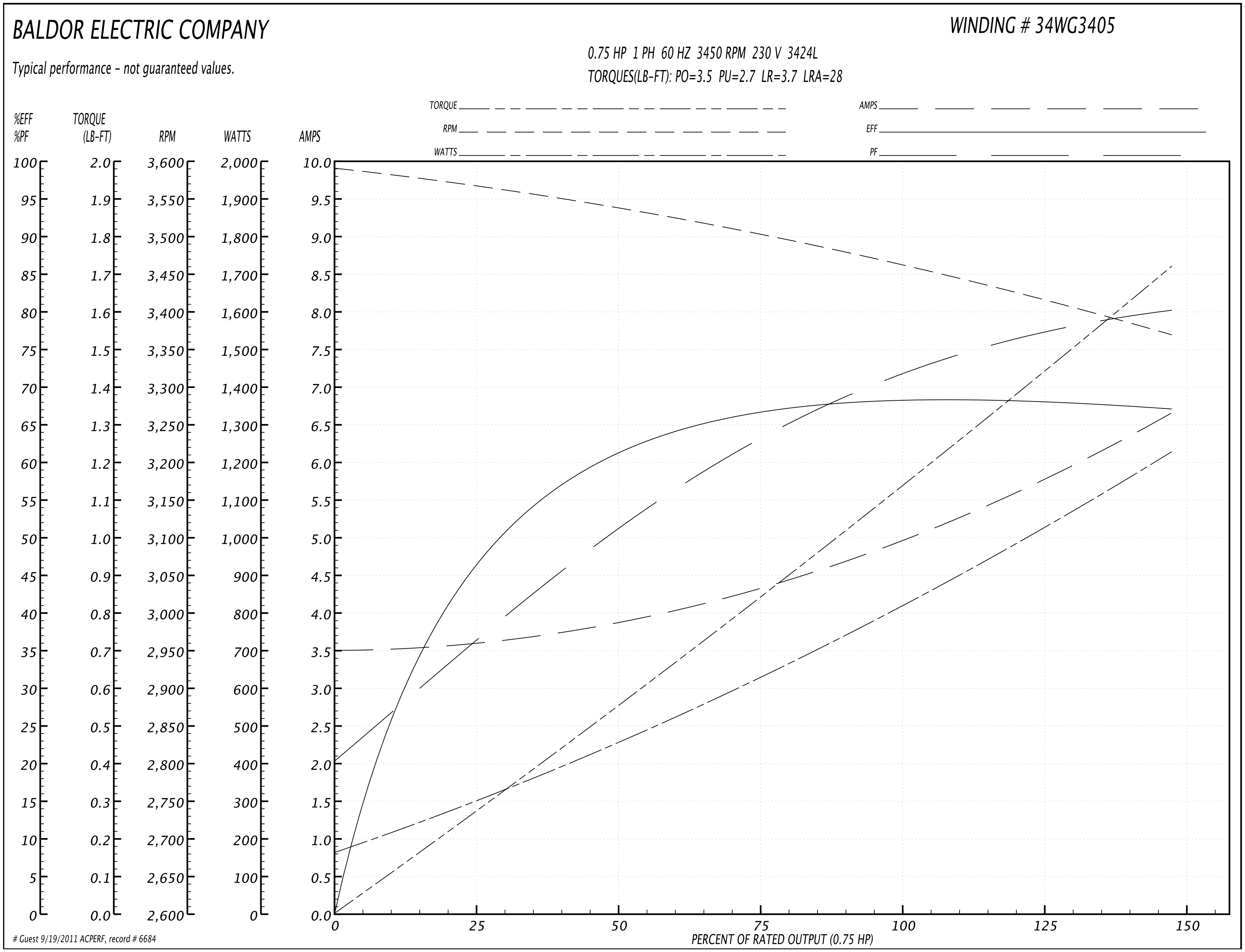
Part Number	Description	Quantity
SA008171	SA 34K43-3405	1.000 EA
RA004618	RA 34K43-3405	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
34CB3002A	CB CAST W/.88 DIA HOLE	1.000 EA
34GS1029A01	GASKET, CONDUIT BOX	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
34EP3102A01SP	FR ENDPLATE, MACH	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	2.000 EA
NS2501A01	INSULATOR, CAPACITOR	1.000 EA
51XB1016A05	10-16X5/16HX WA SL SR TYB (F/S)	2.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
34EP3300A24SP	PU ENDPLATE, MACH	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
34FN3002A01SP	EXTERNAL FAN, PLASTIC, .637/.639 HUB W/	1.000 EA
34FH4002A01SP	IEC FH NO GREASER	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
34CB4517	CB LID 4 MTG HOLES .22 DIA STAMPED, FOR	1.000 EA
34GS1031A01	GASKET, FLAT CONDUIT BOX LID (LEXIDE)	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A04	KEY RETAINER 0.625 DIA SHAFTS	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY 55 GALLONS	0.014 GA
10XF0440S02	04-40 X 1/8 TYPE F HEX HD STAINLESS STIC	2.000 EA

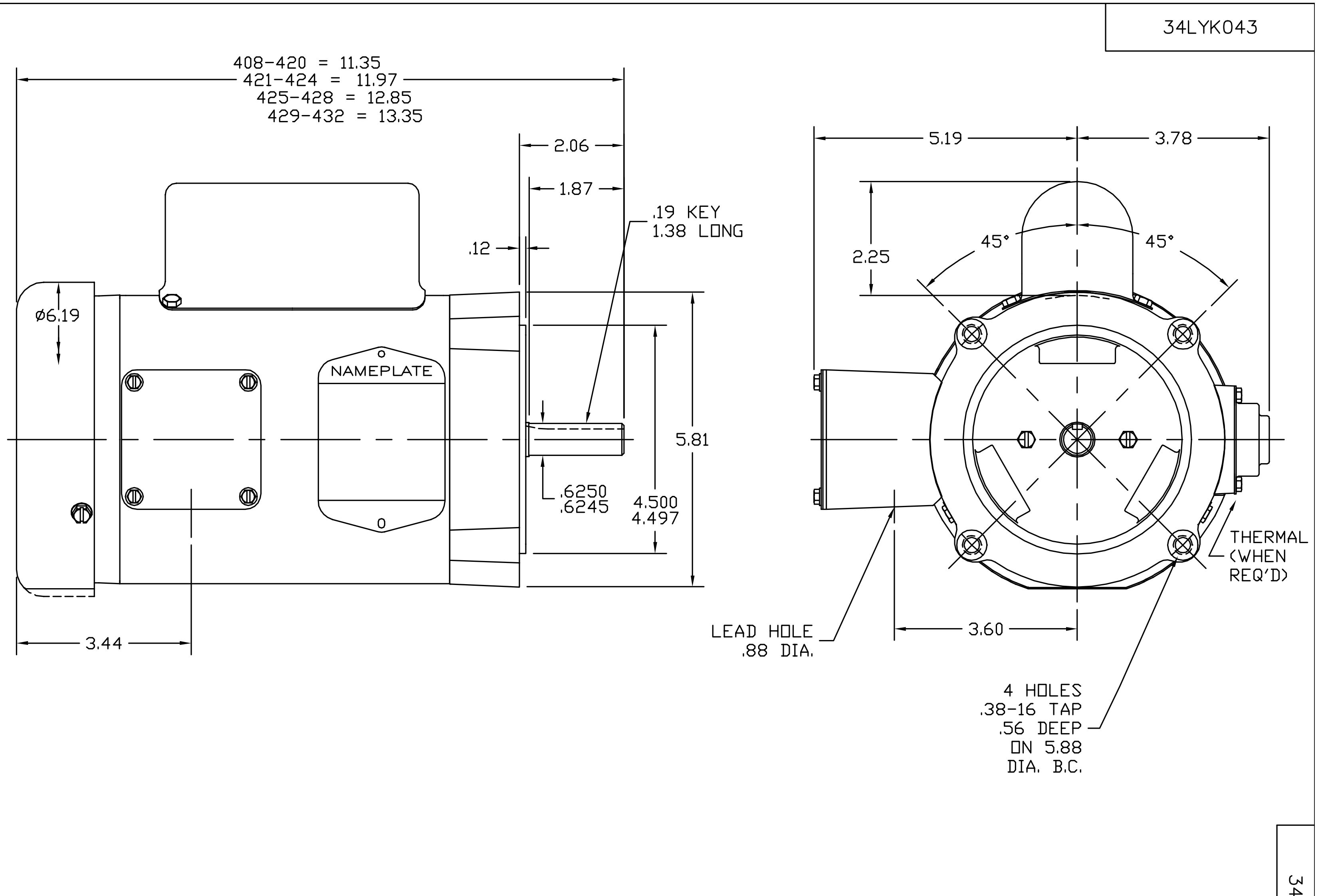
Parts List (continued)

Part Number	Description	Quantity
EC1400A03SP	ELEC CAP, 400-480 MFD, 125V, 1.81D X 3.	1.000 EA
33CB4800A02	CAPACITOR COVER, STAMPED	1.000 EA
35GS3001A02	GASKET, CA.COVER, 5.38 LONG .06 CS301	1.000 EA
SP5056A24	MODEL 34 TYPE L STATIONARY SWITCH WITH L	1.000 EA
HA3100A44	THRUBOLT 10-32 X 8.000	4.000 EA
LB1125C01	STD (STOCK) CARTON LABEL BALDOR WITH FLA	1.000 EA
LC0001A01	CONN LABEL / WARNING LABEL (LC0001 / LB1	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
NP1256L	ALUM, UL CSA CC, W/O THERMAL, LASER	1.000 EA
34PA1005	PACKING GROUP, BALDOR	1.000 EA
PK3083T	STYROFOAM PACKING CRADLE W/TAPE	1.000 EA

Performance Data at 230V, 60Hz, 0.75HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:		1.15 LB-FT		Start Configuration:		DOL	
No-Load Current:		3.5 Amps		Break-Down Torque:		3.5 LB-FT	
Line-line Res. @ 25°C.:		2.5 Ohms A Ph / 2.5 Ohms B Ph		Pull-Up Torque:		2.7 LB-FT	
Temp. Rise @ Rated Load:		78 C		Locked-Rotor Torque:		3.7 LB-FT	
Temp. Rise @ S.F. Load:		92 C		Starting Current:		28.0 Amps	
Load Characteristics							
% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor:	36.0	51.0	62.0	70.0	76.0	81.0	0.0
Efficiency:	47.2	61.1	66.5	68.7	68.7	66.7	0.0
Speed:	3561.0	3534.0	3500.0	3464.0	3421.0	3365.0	0.0
Line Amperes:	3.6	3.9	4.4	5.0	5.7	6.7	5.7

Performance Graph at 230V, 60Hz, 0.75HP Typical performance - Not guaranteed values



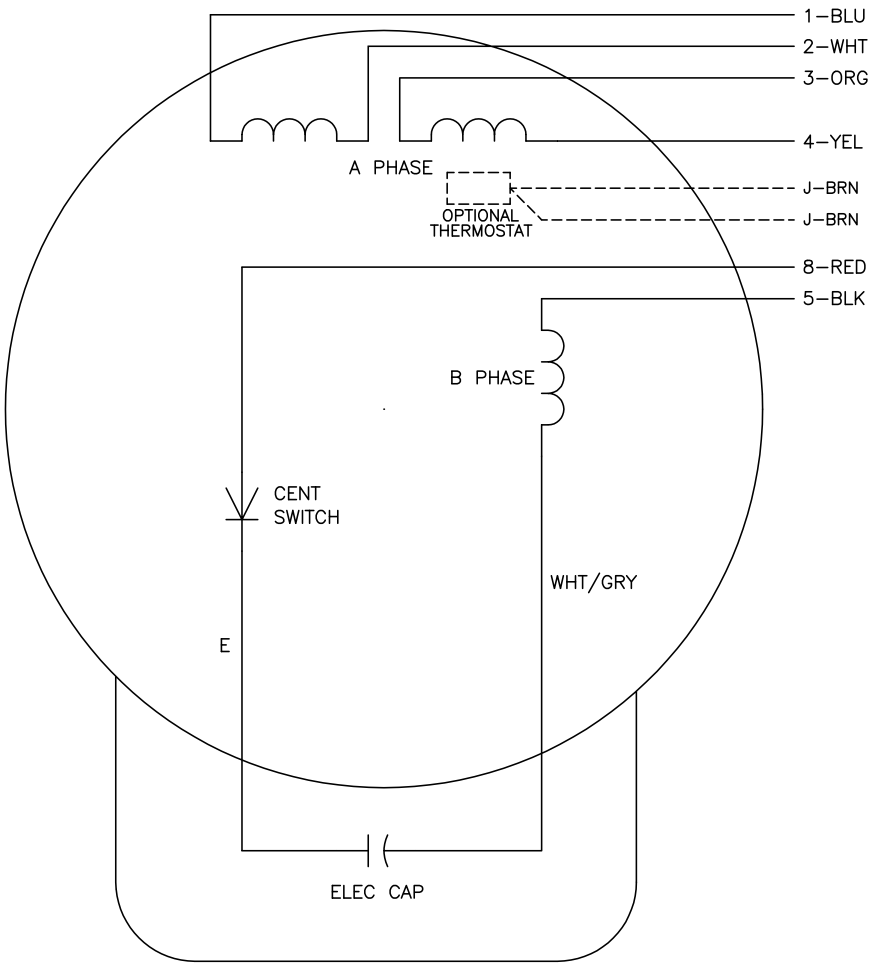


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

REV. DESC: UPDATED KOBX TO 34CB3002A PER BOM			BALDOR ELECTRIC Co.
REV. LTR: D	VERSION: 01	TDR: 000000397764	
34LYK043	FILE: \AAA\00025\911	REVISED: 15:10:02 05/25/2006	STD VERT 34L NEMA 56C TEFC W/35 CAPACITOR BOX
	MTL: –	BY: ENYOAD0	

34LYK043

CD0001



	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	–
LOW OPP	1,3,5	2,4,8	–

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS				BALDOR ELECTRIC Co.
REV. LTR: D	BY: JLP	REVISED: 04/08/99 1:16	TDR: 0178636	
CD0001		FILE: AAA00007405	MDL: –	TYPE L, DV, REV, 6 LEADS
		MTL: –		

CD0001

SDL Project -Tank Sizes						
Clean in Place Tanks and Totes (Provided by New Logic)						
		Capacity	Influent	Capacity	Influent	Fill/Empty
		Metric	Rate	US	Rate	Time
Tank #	Name of Tank	Cubic Meter	m3/hr	Gallons	GPM	Minutes
T-190	Stage 1 CIP Tank	1.0	13.6	264	60.0	4
Process Tanks (Provided by others)						
		Capacity	Influent	Capacity	Influent	Fill/Empty
		Metric	Rate	US	Rate	Time
Tank #	Name of Tank	Cubic Meter	m3/hr	Gallons	GPM	Hours
T-100	VSEP EQ Tank	TBD	TBD	TBD	TBD	TBD
T-110	VSEP Batch Feed Tank	TBD	TBD	TBD	TBD	TBD
T-120	Concentrate Tank	TBD	TBD	TBD	TBD	TBD
T-130	Hot Water Tank	TBD	TBD	TBD	TBD	TBD
T-200	VSEP Permeate Tank T-200	TBD	TBD	TBD	TBD	TBD
T-210	VSEP Permeate Tank T-210	TBD	TBD	TBD	TBD	TBD
T-300	Spiral RO Permeate Tank	TBD	TBD	TBD	TBD	TBD
T-560	50% NaOH Drum	0.2	0.7	55	3.000	18
T-404	VSEP NLR 404 Storage Tote	1.0	0.001	264	0.003	53
T-505	VSEP NLR 505 Storage Tote	1.0	0.001	264	0.003	53

SDL Project -Tank Specifications

Clean in Place Tanks and Totes (Provided by New Logic)									
Tank #	Name of Tank	Preferred Material	Alternate Materials	Jacket	Heat Transfer	Mixing	Pressure	Temp	Instruments
T-190	Stage 1 CIP Tank	Polypropylene	XLPE	None	None	No	Atmospheric	50-60ºC	Level
Process Tanks (Provided by others)									
Tank #	Name of Tank	Preferred Material	Alternate Materials	Jacket	Heat Transfer	Mixing	Pressure	Temp	Instruments
T-100	VSEP EQ Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-110	VSEP Batch Feed Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-120	Concentrate Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-130	Hot Water Tank	304L ss	Polypropylene	Yes	Yes	No	Atmospheric	50-60ºC	Level, Temp
T-200	VSEP Permeate Tank T-200	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-210	VSEP Permeate Tank T-210	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-300	Spiral RO Permeate Tank	304L ss	Polypropylene	None	None	No	Atmospheric	Ambient	Level
T-560	50% NaOH Drum	HDPE	Polypropylene	Yes	None	No	Atmospheric	Ambient	None
T-404	VSEP NLR 404 Storage Tote	HDPE	Polypropylene	None	None	No	Atmospheric	Ambient	None
T-505	VSEP NLR 505 Storage Tote	HDPE	Polypropylene	None	None	No	Atmospheric	Ambient	None

Chem-Tainer Tank Information

Material Selection

Chemtainer.com offers you a selection of materials that are by far the best suited for molded tanks and containers for use with aggressive corrosive chemicals as well as food products. Our 35 plus years of experience in rotational molding, combined with our professional staff of chemical, mechanical and plastics engineers, enables us to provide you with the highest quality rotationally molded tanks and containers available in the industry.

The following is a brief description of these materials:

Polyethylene

A high quality thermoplastic that has outstanding resistance to both physical and chemical attack. The overall general toughness and excellent chemical resistance to a wide array of wet and dry industrial chemicals and food products make polyethylene ideally suited for storage tanks and containers.

Polyethylene is translucent and its natural color ranges from slightly off white to creamy yellow, depending on wall thickness and type. Ultraviolet light stabilizers are added for use in outdoor applications. Colors are available on request for a nominal up charge.

A) Linear Polyethylene

Linear Polyethylene is available as low, medium and high density. Most products offered in this catalog are molded of linear medium density polyethylene (LMDPE) and linear high density polyethylene (LHDPE). They have superior mechanical properties, high stiffness, excellent low temperature impact strength and excellent environmental stress crack resistance. The linear polyethylene used by Chem-Tainer meets specifications contained in FDA regulation 21CFR177.1520 (c) 3.1 and 3.2 and so may be used as an article or a component of articles intended for use in contact with food, subject to any limitations in the regulations. Maximum operating temperature for linear polyethylene is 140° F.

B) Crosslinkable Polyethylene

Crosslinkable polyethylene is a high density polyethylene that contains a crosslinking agent which reacts with the polyethylene during molding, forming a crosslinked molecule similar to a thermoses plastic. This reaction improves toughness and environmental stress crack resistance. Crosslinked Polyethylene (XLPE) is not weldable and does not meet FDA requirement 21CFR177.1520. Maximum operating temperature of crosslinked polyethylene is 150° F.

2) Polypropylene

Polypropylene is a rigid plastic that has a higher operating temperature limit than polyethylene: 212° F. It offers good chemical resistance, has a high resistance to stress crack, and is autoclavable. Polypropylene (PP) is not recommended for applications in sub-freezing temperature or where high impact strength is needed. A rough, irregular interior surface is common characteristic of molded polypropylene.

Considerations to Material Selection

Elevated Temperatures

Continued or prolonged service with contents at elevated temperatures can shorten the life of a tank. The effects of the temperature will depend on the chemical content and its specific gravity, tank size and configuration, material of construction, wall thickness and if there are any external supports on the tank.

Exposure to Ultraviolet Light
Unprotected thermoplastics exposed to sunlight for an extended period of time, absorb ultraviolet (UV) light, which can cause discolorations, embrittlement and eventual cracking. Fluorescent lighting has a similar effect. Elevated temperatures can accelerate the embrittling process. Chem-Tainer products are molded from materials utilizing the latest technology for UV stabilizers which greatly reduce the harmful effects of UV light. For greater protection, keep tanks out of direct sunlight or order dark colored tanks which will further retard the effect of UV light.

Environmental Stress Cracking
Certain surface active materials, although they have no chemical effect on polyethylene, can accelerate its cracking when under stress, such as liquid detergents and ultra pure water- (see our chemical compatibility Chart on pages 46 - 49.) Elevated temperatures tend to accelerate the cracking. Although all polyethylenes are subject to stress cracking, some are more resistant to it than others. The degree of stress on the plastic has a direct bearing on its resistance, therefore a tank and system should be designed to minimize stress. Chemtainer.com tanks are molded visually stress free, employing materials that are highly resistant to environmental stress cracking, and hence are less prone to cracking than fabricated tanks. Stress cracking agents are surface active materials. Proper care should be taken to reduce stress at fillings, bands, tie down lugs, etc.

Characteristics and Physical Properties

General Characteristics	Linear	XLPE	PP
Maximum Service Temp	140 F (60 C)	150 F (65 C)	212 F (100 C)
Chemical Resistance	Very Good	Very Good	Very Good
Stress Crack Resistance	Excellent	Excellent	Excellent
General Toughness	Very Good	Very Good	Fair
Impact Resistance	Excellent	Excellent	Poor
Abrasion Resistance	Good	Good	Good
Rigidity	Good	Good	Good
Color	WH Translucent	Off WH Trans	Off WH Opaque
FDA Compliance	Yes	No	Yes
Outdoor Use	Yes	No	Yes
Weildable	Yes	No	Yes
Recyclable	Yes	No	Yes

Physical Properties (Nominal Values)	Linear	XLPE	PP
Density (gm/cc) ASTM:D1505	0.937-0.942	0.937-0.942	0.901-0.905
Environmental Stress Cracking (F-50hrs) ASTIM:D1693	>1,000	>1,000	>1,000
Tensile Strength ASTIM:D638 Ultimate 2"/Min (PSI) Type IV	2,600	2,600	3,000
Elongation at Break ASTIM:D638 2"/Min(%) Type IV	450	450	5
Flexural Modulus (PSI) ASTIM:D790	100,000-110,000	100,000-110,000	90,000-100,000
Brittleness Temp ASTIM:D746	<-94F (-70 C)	-180 F (-118 C)	32 F (0 C)
VICAT Softening Temp ASTIM:D152B	240F	240F	300F

Tank Handling, Installation & Use Guidelines

Although Chemtainer's tanks are extremely durable, improper handling and installation can result in damage to tank, fittings, and accessories. Failure to comply with handling and installation instructions voids all warranties.

1. At delivery, inspect your tank immediately for defects or shipping damage. Any discrepancies, or product problems, should be noted on both the driver's bill of lading and your packing list.

2. When unloading your tank from the delivery truck, avoid its contact with sharp objects. Forklift blades can cause significant damage if proper precautions are not taken. Do not allow tanks to be rolled over on the fittings. Large bulk storage tanks, whenever possible, should be removed from truck bed by use of a crane or other suitable lifting device. OSHA regulation 29CFR 1910.178 through 1910.189 addresses specific standards for hoisting and lifting. Keep unloading area free of rocks, sharp objects, and other materials that could damage the tank. If tank is unloaded on it's side, carefully brace to prevent rolling.

3. Support bottom of tank firmly and completely. Concrete pads provide the best foundation. However, when seismic and wind factors are not being considered, tanks with a base load bearing of less than 800 pounds per square foot require a firm, even, compacted bed of sand, pea gravel, or fine soil that won't wash away. Tanks with a base load bearing of 800 pounds per square foot, or greater, require a reinforced concrete base. Steel support stands concentrate the loaded tank weight onto the stand leg pads. It is recommended that stands are mounted on a concrete base. Bolting of stands is necessary to prevent movement due to agitation, wind, seismic loads and accidental contact.

4. Install tanks in an area that is accessible. Ease of maintenance and removal should be considered.

5. Test by filling tank with water prior to use, to prevent material loss through unsecured fittings, shipping damage, or manufacturing defects. Tanks should be tested for a minimum 5 hours.

6. Plastic screw on bulkhead fittings are designed to be hand tightened. Overtightening can cause fittings to leak.

7. Support sides of rectangular tanks. In general, tanks with heights greater than 18" must be supported. However, specific applications must be considered: smaller tanks with contents that have high specific gravity and/or elevated temperatures must be supported.

8. Do not mount heavy equipment on tank sides.

9. Do not allow weight on tank fittings. Fully support pipes and valves.

10. Use expansion joints to prevent damage at fittings from the differential expansion and contraction of the piping and tanks.

11. Tanks are designed for use only in the atmospheric storage of chemicals, never for vacuum or pressure applications.

12. Immersion heaters should never touch the walls of the tank. Minimum spacing should be 3" - 4" from wall.

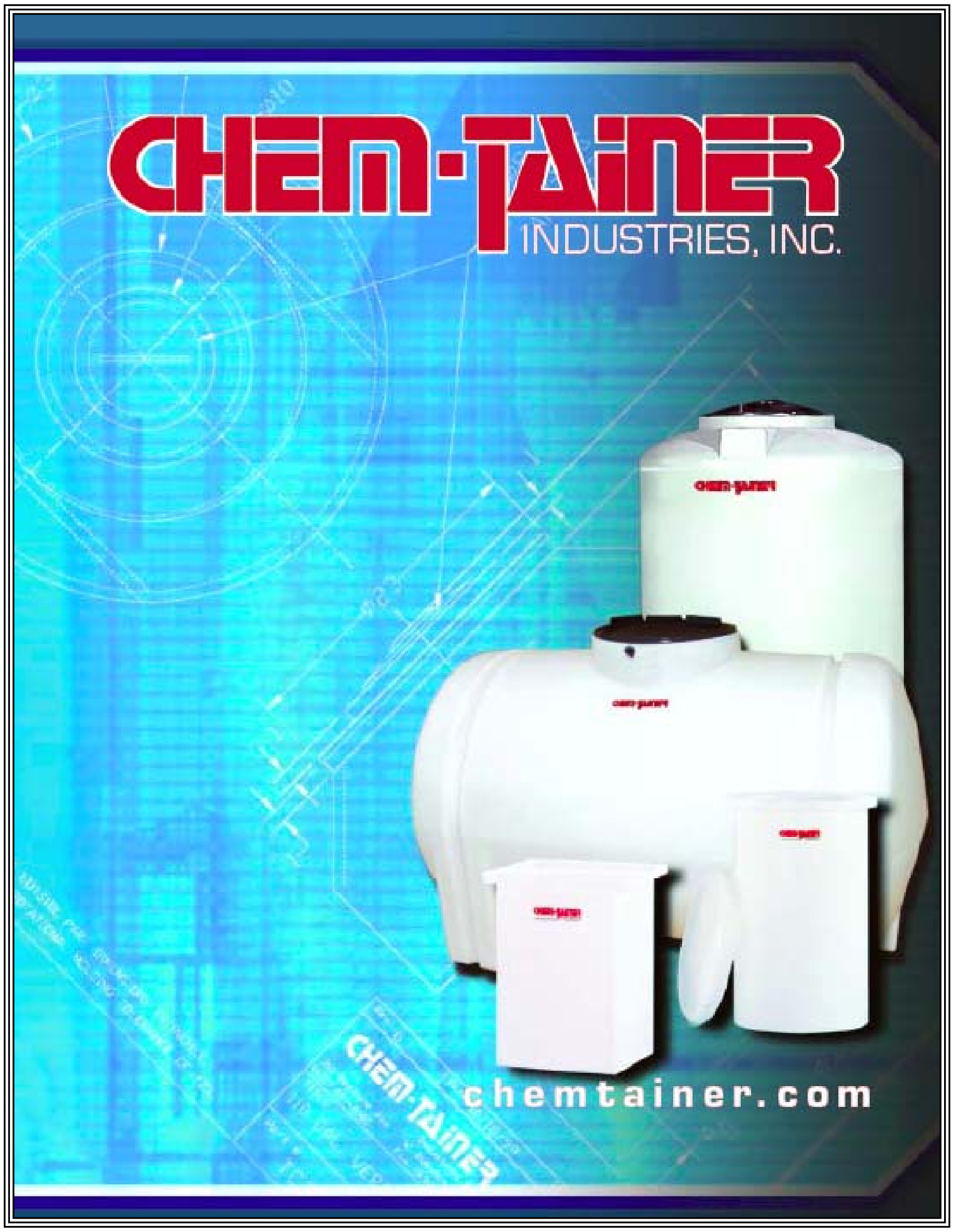
13. Refer to the chemical capability chart on this site as a guide. Be certain tank, fittings, and fitting gasket material are compatible with chemicals at the anticipated operating temperatures. Contact our technical staff for information on chemicals not listed, or when uncertain conditions exist.

14. Protect tanks from impact, especially at temperatures below 40 degrees F.

15. Confined spaces must be considered hazardous. Do not enter tank without first taking proper precautions.

16. Tank sizes as listed are nominal and calibrations on molded tanks are only approximates, but provide an indication of volume. Polyethylene tanks expand and contract which will effect volume. The degree in which this occurs depends on the size of the tanks, wall thickness, specific gravity of contents, temperature of contents and ambient temperatures.

Specifications Manual



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1.0 DESCRIPTION OF TANK

1.1 SPECIFICATIONS (see pages 4-7)

1.2 GENERAL

These are one piece tanks, rotationally molded of linear medium or high density polyethylene or high density crosslinkable polyethylene (XLPE). Refer to material type in the tank charts for availability. Tanks come in a variety of shapes, are available in closed head designs with flat bottom (IC, IA & IX series), conical bottom (JA & JC series), round horizontal (LC & LA series) or oval horizontal (MC & MA series).These tanks can be furnished with various accessories as per customer specifications and are capable of holding aggressive chemicals at atmospheric pressure. Open top mixing and processing tanks are available in cylindrical, conical bottom and rectangular designs, refer to Chem-Tainer product catalog.

2.0 MATERIALS

2.1 LINEAR POLYETHYLENE

A high quality, chemically resistant plastic with high stress crack and impact resistance. Linear polyethylene is translucent and exhibits properties that are ideal for applications that are exposed to low temperatures and/or high impact. Unlike thermosets, linear polyethylene is weldable, thus allowing for greater flexibility when designing modification to our standard tanks. The plastic complies with USDA and FDA regulations for storage and processing of food. Linear polyethylene is fully recyclable and thereby provides a convenient method of disposal.

2.2 CROSS-LINKED POLYETHYLENE

High density cross-linked polyethylene has excellent low temperature impact and environmental stress-crack resistance. This polyethylene is a thermoset, thus does not permit the utilization of welded tank connections. Cross-linked polyethylene does not have USDA or FDA compliance for storage of processing edibles and is not recyclable.

2.3 ULTRA VIOLET LIGHT STABILIZERS AND FILLERS

The plastic does contain a minimum of 0.25 to a maximum of 0.50 long term U.V. stabilizer. It does not contain any fillers.

2.4 PIGMENT

Pigment can be added at purchaser's request. These pigments would be compatible with the polyethylene and will not exceed 0.5% dry blended and 2% compounded in of the total weight.

3.0 TANK CONSTRUCTION

3.1 MECHANICAL PROPERTIES

The minimum for the properties of the material shall be as follows based on molded parts:

PROPERTY	ASTM	VALUE	UNITS
Density	D1505	59 (0.937 - 0.942)	#/ft^{3}(gm/cc)
ESCR Spec. Thickness			
125 Mils F-50	D1693	1000	Hrs.
Tensile Strength	D638		
Ultimate 2”/min.	Type IV Spec.	2600	PSI
Elongation at break	D638		
2”/min.	Type IV Spec.	450	%
Vicat Softening Temp.	D1525	240	Deg. F
Brittleness Temp.	D746	-180	Deg. F
Flexuarl Modulus	D790	100,000-110,000	PSI

3.2 APPEARANCE

The finished surface of the tank shall be free as commercially practicable from visual defect such as foreign inclusions, air bubbles, pin holes, craters, crazing and cracking that will impair the serviceability of the tank.

3.3 CUT EDGES

All edges cut out i.e., open top flanges, manways, shall be trimmed to have smooth edges.

3.4 DIMENSIONS AND TOLERANCES

General - all dimensions will be taken with the tank in its proper, usable position and unfilled. Tank dimensions will represent the exterior measurements.

3.4.1 Outside diameter – The tolerance for the outside diameter including out of roundness, shall be +/-3%.

3.4.2 3.4.2 Shell wall and head thickness - The tolerance for thickness shall be +/-20% of the design thickness. The total amount of an area on the low side of the tolerance shall not exceed 10% of the total area and individual area shall not exceed 1 ft. 2 (.09m2) in size.

3.5 PERFORMANCE REQUIREMENTS

The following performance requirements shall be conducted on samples taken from the manway cut out area or where fittings are inserted in each tank

3.5.1 Low Temperature Impact
Low temperature impact is determined by using a 30 lb. Falling dart at -20 degrees F.

Wall thickness in. (mm)	ft-lb. (J) to fail.
Less than & including 0.25 in. (6.6 mm)	90 (122.0)
0.26 in. (6.6 mm) to & including 0.50 in. (12.9 mm)	100 (135.5)
0.51 in. (12.9 mm) to & including 0.75 in. (19.3 mm)	150 (203.2)
0.76 in. (19.3 mm) to & including 1.00 in. (25.4 mm)	200 (271.0)

3.5.2 Percent Gel - for crosslinked polyethylene
The percent gel level is determined by using the test method found in ASTM D1998. The percent gel level for crosslinked tanks on the inside 0.125 in. (3.2mm) of the wall shall be a minimum of 60%.

3.5.3 Visual Inspection - The tank is visually inspected to determine such qualities as are discussed in Section 3.2, Appearance.

4.0 MARKINGS

4.1 The tank is marked to identify the producer - Chem-Tainer, Inc., date (month and year) of manufacture, capacity and serial number.

4.2 The proper caution and/or warning signs are affixed to the tank

4.3 Tank capacities should be based on total tank volume.

5.0 PACKAGING AND SHIPPING

5.1 All fittings and flange faces shall be protected from damage by covering with suitable plywood, hard-board or plastic securely fastened. Tanks shall be positively vented at all times.

5.2 Pipe and tubing, fittings and miscellaneous small parts shall be packaged. Loose items which may scratch the interior surface shall not be placed inside the tank during shipment. Additional protection, such as battens, end wrapping, cross bracing, or other interior fastenings may be required to assure each individual equipment pieces are not damaged in transit.

5.3 Upon arrival at the destination, the purchaser is advised to inspect for dam age in transit. If damage has occurred, a claim should be filled with the carier by the purchaser. The supplier should be notified if the damage is not first repaired by the fabricator prior to the product being put into service. The purchaser accepts all future responsibility for the effect of the tank failure resulting from damage.

5.4 It is recommended that the tank be hydrostacially tested at the time of installation.

ON PAGES 5-8 ARE LISTED
TANK DIMENSIONS
GALLONAGE
MATERIALS OF CONSTRUCTION
AND
SPECIFIC GRAVITY RATINGS
FOR ALL CHEM-TAINER BULK STORAGE TANKS.

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CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR POLYETHYLENE VERTICAL FLAT BOTTOM
BULK STORAGE TANKS IC, IA AND IX SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
20	TA1628IC	16	28	8	Linear	1.5
25	TA1829IC	18	29	5	Linear	1.5
40	TA1841IC	18	41	5	Linear	1.5
45	TC1851IA	18	51	4	Linear	1.9
55	TC2038IA	20	38	8	Linear	1.9
65	TC2338IA	23	38	8	Linear	1.9
75	TC2349IA	23	49	8	Linear	1.9
100	TC2360IA	23	60	8	Linear	1.9
110	TC3536IC	35	36	8	Linear	1.5
110	TC3536IA	35	36	8	Linear	1.9
110	TC3635IX	35	36	8	XLPE	1.9
130	TC2376IC	23	76	8	Linear	1.5
130	TC2376IA	23	76	8	Linear	1.5
160	TA2866IC	28	66	8	Linear	1.5
165	TC3158IC	31	58	8	Linear	1.5
165	TC3158IA	31	58	8	Linear	1.9
210	TA4048IC	40	48	5	Linear	1.5
220	TC3563IC	35	63	8	Linear	1.5
220	TC3563IA	35	63	8	Linear	1.9
220	TC3563IX	35	63	8	XLPE	1.9
225	TA3172IC	31	72	8	Linear	1.5
300	TC3581IC	35	81	16	Linear	1.5
300	TC3581IA	35	81	16	Linear	1.9
300	TC3581IX	35	81	16	XLPE	1.9
300	TC4259IC	42	59	16	Linear	1.5
300	TC4259IA	42	59	16	Linear	1.9
300	TC4560IC	45	60	16	Linear	1.5
300	TC4560IA	45	60	16	Linear	1.9
300	TA4254IC	42	54	8	Linear	1.5
425	TA4275IC/IA	42	75	8	Linear	1.5 / 1.9
500	TA4676IC/IA	46	76	16	Linear	1.5 / 1.9
500	TC4676IC	46	76	16	Linear	1.5
500	TC4676IA	46	76	16	Linear	1.9
500	TC4676IX	46	76	16	XLPE	1.9
500	TC6442IC	64	42	16	Linear	1.5
500	TC6442IA	64	42	16	Linear	1.9
500	TC6442IX	64	42	16	XLPE	1.9
550	TC4594IC	52	66	16	Linear	1.5
550	TC4594IA	45	94	16	Linear	1.5
550	TN6742IC	45	94	16	Linear	1.9
550	TA5266IC/IA	67	42	16	Linear	1.5 / 1.9
650	TC5660IC	56	60	16	Linear	1.5
650	TC5660IA	56	60	16	Linear	1.9
700	TC6460IC	64	60	16	Linear	1.5
700	TC6460IA	64	60	16	Linear	1.9
750	TC750XIC	46	119	16	Linear	1.5
750	TC750XIA	46	119	16	Linear	1.9

VERTICAL FLAT BOTTOM BULK STORAGE TANKS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
850	TC850XIC	48	124	16	Linear	1.5
850	TC850XIA	48	124	16	Linear	1.9
850	TC850XIX	48	124	16	XLPE	1.9
850	TA5492IC/IA	54	92	8	Linear	1.5/1.9
1000	TA6481IC/IA	64	81	16	Linear	1.5/1.9
1000	TN6481IC	64	81	16	Linear	1.5
1000	TN6481IA	64	81	16	Linear	1.9
1000	TC6481IX	64	81	16	XLPE	1.9
1000	TN6974IC	69	74	16	Linear	1.5
1000	TN6974IA	69	74	16	Linear	1.9
1100	TN8751IC	87	51	16	Linear	1.5
1100	TN8751IA	87	51	16	Linear	1.9
1200	TC8652IC	86	52	16	Linear	1.5
1200	TC8652IA	86	52	16	Linear	1.9
1200	TC8652IX	86	52	16	XLPE	1.9
1300	TN8758IC	87	58	16	Linear	1.5
1500	TA1500IC/IA	64	115	16	Linear	1.5/1.9
1500	TA8569IC/IA	85	69	16	Linear	1.5/1.9
1500	TC1500IC	64	121	16	Linear	1.5
1500	TC1500IA	64	121	16	Linear	1.9
1500	TC1500IX	64	121	16	XLPE	1.9
1550	TN8765IC	87	65	16	Linear	1.5
1550	TN8765IA	87	65	16	Linear	1.9
1650	TA8574IC/IA	85	74	16	Linear	1.5/1.9
1700	TC8674IC	86	74	16	Linear	1.5
1700	TC8674IA	86	74	16	Linear	1.9
1700	TC8674IX	86	74	16	XLPE	1.9
2000	TA2000IC/IA	64	156	16	Linear	1.5/1.9
2000	TA9083IC/IA	90	83	16	Linear	1.5/1.9
2000	TC2000IC	64	144	16	Linear	1.5
2000	TC2000IA	64	144	16	Linear	1.9
2000	TC2000IX	64	144	16	XLPE	1.9
2100	TN8787IC	87	87	16	Linear	1.5
2100	TN8787IA	87	87	16	Linear	1.9
2200	TC8696IC	86	96	16	Linear	1.5
2200	TC8696IA	86	98	16	Linear	1.9
2200	TC8696IX	86	96	16	XLPE	1.9
2500	TC9589IC	95	89	16	Linear	1.5
2500	TC9589IA	95	89	16	Linear	1.9
2500	TA2500IC/IA	90	100	16	Linear	1.5/1.9
2800	TC9598IC	95	98	16	Linear	1.5
2800	TC9598IA	95	98	16	Linear	1.9
2800	TC9598IX	95	98	16	XLPE	1.9
3000	TC3000IC	95	105	16	Linear	1.5
3000	TC3000IA	95	105	16	Linear	1.9
3000	TA3000IA	90	118	16	Linear	1.5
3200	TC3200IC	95	112	16	Linear	1.5
3200	TC3200IA	95	112	16	Linear	1.9
3200	TC3200IX	95	112	16	XLPE	1.9
3600	TC3600IC	86	156	16	Linear	1.5
3600	TC3600IA	86	156	16	Linear	1.9
3600	TC3600IX	86	156	16	XLPE	1.9
4000	TC4000IA	95	140	16	Linear	1.9
4000	TC4001IC	102	125	16	Linear	1.5
4000	TC4001IA	102	125	16	Linear	1.9
4000	TA4000IC/IA	96	140	16	Linear	1.5/1.9

VERTICAL FLAT BOTTOM BULK STORAGE TANKS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
4300	TC4300IC	120	105	16	Linear	1.5
4300	TC4300IA	120	105	16	Linear	1.9
4300	TC4300IX	120	105	16	XLPE	1.9
4500	TC4500IC	95	156	16	Linear	1.5
4500	TC4500IA	95	156	16	Linear	1.9
4500	TC4500IX	95	156	16	XLPE	1.9
5000	TC5000IC	102	151	16	Linear	1.5
5000	TC5000IA	102	151	16	Linear	1.9
5150	TA5150IC/IA	102	159	16	Linear	1.5/1.9
5600	TC5600IC	120	138	16	Linear	1.5
5600	TC5600IA	120	138	16	Linear	1.9
6250	TA6250IC/IA	102	194	16	Linear	1.5/1.9
6800	TC6800IC	120	150	16	Linear	1.5
6800	TC6800IA	120	150	16	Linear	1.9
6800	TC6800IX	120	150	16	XLPE	1.9
7800	TA7800IC/IA	120	178			
9000	TN9000IC	141	144	16	Linear	1.5
9000	TN9000IA	141	144	16	Linear	1.9
9150	TA9150IC/IA	120	206	16	Linear	1.5/1.9
10500	T10500IC	142	175	16	Linear	1.5/1.9
12000	T12000IC	141	192	16	Linear	1.5
12000	T12000IA	141	192	16	Linear	1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR POLYETHYLENE CONICAL BOTTOM
BULK STORAGE TANKS JC AND JA SERIES

1.1 SPECIFICATIONS

Tank Size (Gallons)	Model Number	Diameter (inches)	Height (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
200	TA4254JC/JA	42	54	Linear	1.5/1.9
300	TA4265JC/JA	42	65	Linear	1.5/1.9
345	TA5256JC/JA	52	56	Linear	1.5/1.9
350	TA4282JC/JA	42	82	Linear	1.5/1.9
500	TA5279JC/JA	52	79	Linear	1.5/1.9
1000	TA6498JC/JA	64	98	Linear	1.5/1.9
1500	TC8684JC	86	84	Linear	1.5
1500	TC8684JA	86	84	Linear	1.9
1600	TA9090JC	90	90	Linear	1.5
1700	TA8583JC/JA	85	83	Linear	1.5/1.9
2500	TA2500JC/JA	90	108	Linear	1.5/1.9
2600	TA2600JC/JA	90	126	Linear	1.5/1.9
2600	TA2600JC/JA	85	144	Linear	1.5/1.9
2650	TC2650JC	86	132	Linear	1.5
2650	TC2650JA	86	132	Linear	1.9
3000	TA3000JC/JA	90	125	Linear	1.5/1.9
4600	TA4600JC/JA	102	155	Linear	1.5/1.9
4900	TA4900JC/JA	102	159	Linear	1.5/1.9
5500	TN5500JC	119	146	Linear	1.5
5500	TN5500JA	119	146	Linear	1.9
7500	TN7500JC	141	148	Linear	1.5
7500	TN7500JA	141	148	Linear	1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR ELLIPTICAL HORIZONTAL BOTTOM
BULK STORAGE TANKS LC AND LA SERIES

1.1 **SPECIFICATIONS**

Tank Size (Gallons)	Model Number	Diameter (inches)	Length (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73° Fahrenheit
15	TA1430LC	14	30	5	Linear	1.5
25	TA1634LC	16	34	5	Linear	1.5
30	TC2218LA	22	18	4	Linear	1.9
35	TA1834LC/LA	18	34	5	Linear	1.5/1.9
65	TC2343LA	23	43	5	Linear	1.9
65	TA2439LC	24	39	5	Linear	1.5/1.9
125	TA3240LC	32	40	8	Linear	1.5/1.9
165	TA3251LC	32	51	8	Linear	1.5/1.9
200	TC3845LA	38	45	8	Linear	1.5
200	TC3845LA	38	45	8	Linear	1.9
225	TA3852LC/LA	38	52	8	Linear	1.5/1.9
300	TC3866LC	38	66	16	Linear	1.5
300	TC3866LA	38	66	16	Linear	1.9
335	TA4456LC/LA	44	56	16	Linear	1.5/1.9
535	TA4878LC/LA	48	78	16	Linear	1.5/1.9
735	TA735XLC/LA	48	103	16	Linear	1.5/1.9
925	TA6281LC/LA	62	81	16	Linear	1.5/1.9
1065	TA1065LC/LA	58	106	16	Linear	1.5/1.9
1300	TA1300LC/LA	62	114	16	Linear	1.5/1.9
1625	TN1625LC/LA	63	134	16	Linear	1.5/1.9

CHEM-TAINER INDUSTRIES, INC

SPECIFICATIONS FOR POLYETHYLENE ELIPTICAL HORIZONTAL
BULK STORAGE TANKS MC AND MA SERIES

1.1 **SPECIFICATIONS**

Tank Size (Gallons)	Model Number	Length (inches)	Width (inches)	Height (inches)	Manway (inches)	Material (type)	Specific Gravity Rating at 73°Fahrenheit
200	TA200XMC/MA	41	66	26	8	Linear	1.5/1.9
300	TA300XMC/MA	48	70	30	8	Linear	1.5/1.9
400	TA400XMC/MA	57	70	36	8	Linear	1.5/1.9
500	TA500XMC/MA	57	82	36	8	Linear	1.5/1.9
500	TC500XMC	80	53	45	16	Linear	1.5
500	TC500XMA	80	53	45	16	Linear	1.9
750	TA750XMC/MA	69	89	42	16	Linear	1.5/1.9
1000	TA1000MC/MA	78	90	49	16	Linear	1.5/1.9
1000	TC1000MC	145	53	45	16	Linear	1.5
1000	TC1000MA	145	53	45	16	Linear	1.9
1035	TA1035MC/MA	78	90	52	16	Linear	1.5/1.9
1235	TC1235MC	125	68	50	16	Linear	1.9
1600	TA1600MC/MA	78	138	49	16	Linear	1.5/1.9
2350	TA2350MC/MA	88	146	63	16	Linear	1.5/1.9
2635	TN2635MC	140	90	71	16	Linear	1.5
2635	TN2635MA	140	90	71	16	Linear	1.9
3200	TA3200MC/MA	88	172	74	16	Linear	1.5/1.9
4035	TN4035MC/MA	192	92	77	16	Linear	1.5/1.9

PASSPORT IBC™

FXSM and FXUM • Steel Pallet — World-class Material Handling Solution

For more information, visit
www.clawsoncontainer.com

When choosing your IBC packaging, Clawson Container Company recognizes three factors that influence your decision.

Advantage One: Manufacturing

- **Quality Assurance** - An ISO 9002 certified manufacturer ensures a consistent reliable product.
- **Highest Output** - Efficient automated manufacturing ensures on time shipping at a competitive price.
- **Regulatory Compliance** - The FXUM is labeled UN 31 HA1 for the handling and transport of Class II and III hazardous materials.

Advantage Two: Innovation

- **Pallet** - The steel pallet's nesting design, welded corners and four-way access results in a package that is efficient to handle and can be stacked with virtually all commercial container types and handling systems.
- **Bottle** - Made of blow-molded high-density polyethylene the bottle is compatible with the broadest range of chemicals and food grade products.
- **Cage** - Combining the superior strength of a square tubular design and the patented four-point welding process at each cross bar, we have created a cage that provides dynamic stability under extreme loads.

Advantage Three: Service

- **Environmentally Responsible** - *ReturnNet System* global container management program, ensures the proper recycling and handling of *Passport IBCs*.
- **Global Availability** - Through *PacNet*, *Passport IBCs* are available from state-of-the-art facilities and distribution points in the U.S.A., Italy, Spain and Germany.

1-800-325-8700

http://www.clawsoncontainer.com
E-MAIL: info@clawsoncontainer.com
TEL: (248) 625-8700 • FAX: (248) 625-3066
4545 Clawson Tank Drive • Clarkston, MI 48346

RETURNnet SYSTEM 1-888-758-7447

PACnet MEMBER

CLAWSON CONTAINER COMPANY

Passport IBC

Clawson Container Company – Dependability you can count on!

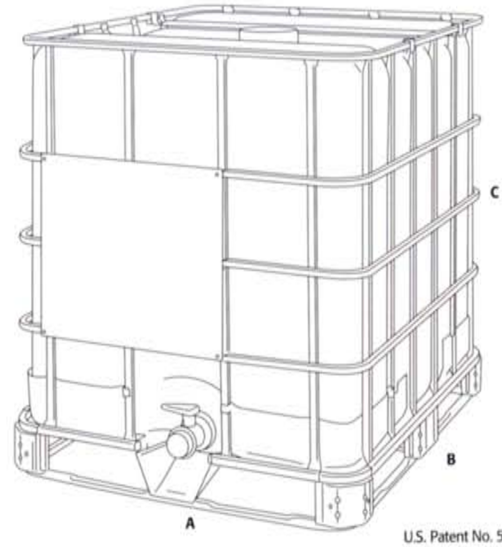
For more product information contact Clawson direct.

By Phone: 1-800-325-8700 or (248) 625-8700

Press 1	Sales/Order Placement
Press 2	Customer Service
Press 3	Technical Services

By E-mail:

info@clawsoncontainer.com	General Information
sales@clawsoncontainer.com	Sales/Order Placement
service@clawsoncontainer.com	Customer Service
tech@clawsoncontainer.com	Technical Services



U.S. Patent No. 5645185

TECHNICAL SPECIFICATIONS

Model No: FXSM and FXUM / Steel Pallet

Capacity

Nominal	220-gallon	833-liter	275-gallon	1040-liter	330-gallon	1249-liter
Actual	218-gallon	825-liter	280-gallon	1060-liter	338-gallon	1279-liter

Dimensions

Width (A)	40"	1016 mm	40"	1016 mm	40"	1016 mm
Depth (B)	48"	1219 mm	48"	1219 mm	48"	1219 mm
Height (C)	39"	990 mm	46"	1168 mm	54"	1270 mm

Bottle

VOLUME INDICATOR	FILL OPENING (ID)	DISCHARGE OPENING (ID)	BLOWING MOLDING
Molded gallon & liter	5 5/8" 143 mm	2 1/4" 57 mm	High Molecular HDPE/UV

Fill

DIAMETER	MATERIAL	GASKET	THREAD
6"/150 mm	HDPE	Sponge Rubber	Buttress

Discharge

DIAMETER	TYPE	MATERIAL	GASKET	DUST CAP GASKET	THREAD	TAMPER EVIDENT
2"/50 mm	Plunger	HDPE	Viton	Sponge Rubber	NPT	Foil seal/Locking Pin/Thread Seal

Frame

MATERIAL	MANUFACTURING	COATING	INFORMATION PLATE
Tubular Steel Grid	Four-point electro-welded	Zinc Galvanized	19" x 21" / 483 mm x 522 mm

Pallet

MATERIAL	STACKING	HANDLING
Galvanized stamped sheet steel	Interlocking Safety Design	Four-way Access

Regulatory

** See IBC Handling Guide*

UN LABELING	STATIC LOAD	DYNAMIC LOAD	TEST METHODS	MATERIALS	SPECIFIC GRAVITY
31 HA1	3 High	2 High*	H20 Bath/2.9 PSIG	FDA Approved	1.9

Transport Weights

** Actual weights may vary.*

	220-gallon/833-liter		275-gallon/1040-liter		330-gallon/1249-liter	
Tare Weight	128 lbs.	58 kg.	144 lbs.	65 kg.	160 lbs.	73 kg.
Gross Weight	3582 lbs.	1625 kg.	4517 lbs.	2049 kg.	4627 lbs.	2099 kg.

Transport Loads

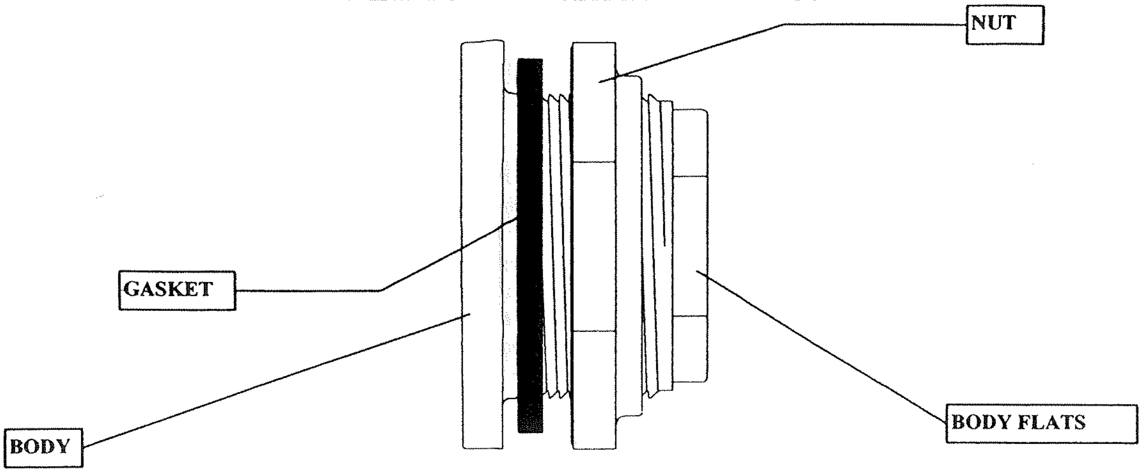
SEMITRAILER 48'	SEMITRAILER 53'	ISO CONTAINER 20'	ISO CONTAINER 40'	RAIL CAR
56 units	60 units	20 units	40 units	up to 150 units

Options

VALVES AND GASKETS	FILL OPENING AND CAPS	PALLET / FRAME
2" Plunger NPT w/Viton and EPDM	**9" SCREW CAP**	**PALLET**
2" Plunger NPT / Food Grade	50 mm Buttress Bung	Plastic
2" Plunger NPT w/EPDM	50 mm Buttress Membrane Vent	Wood
2" Ball Valve NPT w/Viton or EPDM	**6" SCREW CAP**	**INFORMATION PLATE**
2" Ball Valve Quick Connect w/Viton or EPDM	2" NPT Bung	28" x 30" /
	50 mm Buttress Membrane Vent	710 mm x 760 mm

HAYWARD INDUSTRIAL PRODUCTS

INSTALLATION DATA FOR SAFE-T-LOC™ BULKHEAD FITTINGS



PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD VALVES, STRAINERS, FILTERS, AND OTHER ASSOCIATED PRODUCTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS INJURY.

1. Hayward guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for damage or injuries resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for damage or injury resulting from chemical incompatibility between its products and the process fluids to which they are subjected. Compatibility charts provided in Hayward literature are based on ambient temperatures of 70 °F and are for reference only. Customer should always test to determine application suitability.
3. Consult Hayward literature to determine operating pressure and temperature limitations before installing any Hayward product. Note that the maximum recommended fluid velocity through any Hayward product is eight feet per second. Higher flow rates can result in possible damage due to the water hammer effect. Also note that maximum operating pressure is dependent upon material selection as well as operating temperature.
4. Hayward products are designed primarily for use with non-compressible liquids. They should NEVER be used or tested with compressible fluids such as compressed air or nitrogen.
5. Systems should always be depressurized and drained prior to installing or maintaining Hayward products.
6. Temperature effect on piping systems should always be considered when the systems are initially designed. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward equipment due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
7. Because PVC and CPVC plastic products become brittle below 40 °F, Hayward recommends caution in their installation and-use below this temperature.
8. Published operating torque requirements are based upon testing of new valves using clean water at 70 °F. Valve torque is affected by many factors including fluid chemistry, viscosity, flow rate, and temperature. These should be considered when sizing electric or pneumatic actuators.
9. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration, and pipe loading forces DIRECT INSTALLATION OF METAL PIPE INTO PLASTIC CONNECTIONS IS NOT RECOMMENDED. Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameter in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.

INSTALLATION INSTRUCTIONS:

The following table, in inches, are recommended values.

Bulkhead size	**Min Rigid** Tank ID	**Min Flexible** Tank ID	**Max** Wall	**Min** Hole	**Max** Hole
1/2"	7.25	5.56	1.08	1.38	1.41
3/4"	10.00	7.75	1.15	1.63	1.66
1"	11.75	8.94	1.15	1.87	1.91
1-1/4"	16.25	12.19	1.02	2.37	2.41
1-1/2"	16.25	12.19	1.02	2.37	2.41
2"	25.75	19.38	1.09	3.25	3.28
3"	42.50	36.25	1.14	4.50	4.54
4"	90.00	76.81	1.69	5.72	5.78

THE SYSTEM AND TANK SHOULD BE DEPRESSURIZED AND DRAINED BEFORE ATTEMPTING TO INSTALL A BULKHEAD FITTING. VENTING AND PROPER PERSONAL PROTECTION EQUIPMENT SHOULD BE USED WHEN ENTERING TANKS.

THE BULKHEAD FITTING SHOULD BE INSTALLED WITH THE BODY AND THE GASKET ON THE INSIDE OF THE TANK. TIGHTEN THE NUT WHILE HOLDING THE BODY. THE NUT CAN BE TIGHTENED FROM THE OUTSIDE OF THE TANK BY HOLDING THE FLATS ON THE BODY END WHILE TURNING THE NUT.

THREADED CONNECTION:

Threaded end connections are manufactured to ASTM specifications D2464-88. F437-88 and ANSI B2.1. Wrap threads of pipe with Teflon tape of 3 to 3-1/2 mil thickness. The tape should be wrapped in a clockwise direction starting at the first or second full thread. Overlap each wrap by, 1/2 the width of the tape. The wrap should be applied with sufficient tension to allow the threads of a single wrapped area to show through without cutting the tape. The wrap should continue for the full effective length of the thread. Pipe sizes 2" and greater will not benefit with more than a second wrap, due to the greater thread depth. To provide a leak proof joint, the pipe should be threaded into the bulkhead fitting "hand tight". Using a strap wrench only. (Never use a stillson type wrench) tighten the joint an additional 1/2 to 1-1/2 turns past hand tight. Tightening beyond this point may induce excessive stress that could cause failure.

SOCKET CONNECTION:

Socket connections are manufactured to ASTM D2467-94. Solvent cementing of socket connections to pipe should be performed per ASTM specifications D2855-87. Cut pipe square. Chamfer and deburr pipe. Surfaces must be cleaned and free of dirt, moisture, oil and other foreign material. Apply primer to inside socket surface. Use a scrubbing motion. Repeat applications may be necessary to soften the surface of the socket. Next, liberally apply primer to the male end of the pipe to the length of the socket depth. Again apply to the socket, without delay apply cement to the pipe while the surface is still wet with primer. Next apply cement lightly, but uniformly to the inside of the socket. Apply a second coat of cement to the pipe, and assemble the pipe into the socket, rotating the pipe 1/4 turn in one direction as it is slipped to full depth of the socket. The pipe should be held in position for approx. 30 seconds to allow the connection to "set". After assembly wipe off excess cement. Full set time is a minimum of 30 minutes at 60 to 100 F. Full cure time should be based on the chart below.

JOINT CURE SCHEDULE:

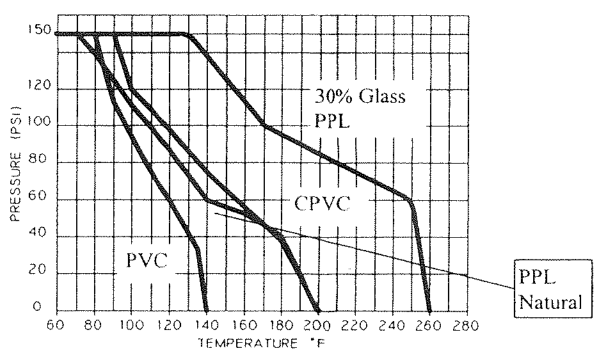
The cure schedules are suggested as guides. They are based on laboratory test data, and should not be taken to be the recommendations of all cement manufacturers. Individual manufacturer's recommendations for their particular cement should be followed.

	Test Pressures for Pipe Sizes ½" to 1-1/4"		Test Pressures for Pipe Sizes 1-1/2" to 3"		Test Pressures for Pipe Sizes 4" & 5"		Test Pressures for Pipe Sizes 6" to 8"	
Temperature Range During Cure Period(B) °F(°C)	Up to 180 PSI (1240 kPa)	Above 180 to 370 PSI (1240 to 2550 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)	Up to 180 PSI (1240 kPa)	Above 180 to 315 PSI (1240 to 2172 kPa)
60 to 100 (15 to 40)	1 hour	6 hours	2 hours	12 hours	6 hours	18 hours	8 hours	1 day
40 to 60 (5 to 15)	2 hours	12 hours	4 hours	1 day	12 hours	36 hours	16 hours	4 days
20 to 40 (-7 to 5)	6 hours	36 hours	12 hours	3 days	36 hours (A)	4 days (A)	3 days (A)	9 days (A)
10 to 20 (-15 to 7)	8 hours	2 days	16 hours	4 days	3 days (A)	8 days (A)	4 days (A)	12 days (A)
Colder than 10 (-15)	Extreme care should be exercised on all joints made where pipe, fittings or cement is below 10°F.							

A: It is important to note that at temperatures colder than 20°F on sizes that exceed 3 in., test results indicate that many variables exist in the actual cure rate of the joint. The data expressed in these categories represent only estimated averages. In some cases, cure will be achieved in less time, but isolated test results indicate that even longer periods of cure may be required.

B: These cure schedules are based on laboratory test data obtained on Net Fit Joints (NET FIT=in a dry fit the pipe bottoms snugly in the fitting socket without meeting interference).

NON SHOCK OPERATING PRESSURES



CAUTION:

When installing the bulkhead fitting in a large diameter tank, care should be used to assure the initial thread engagement to the mating part outside the tank, is minimized. This will allow final position of the bulkhead fitting to be adjusted after the tank is filled.

After the tank is filled, if a slight leak develops around the fitting, it may be necessary to slightly loosed the nut and rotate the entire bulkhead body counterclockwise, while holding the mating part stationary. This will draw the bulkhead fitting body toward the inside tank wall. **RETIGHTEN** the bulkhead fitting nut, while holding the flats on the body.

NEW LOGIC RESEARCH, INC.
1295 67th St. Emeryville, CA 94608 510.655.7305 510.655.7307 fax www.vsep.com

Certificate of Compliance

ASTM D2996-88
Standard Specification for Filament Wound Machine Made Fiberglass Pipe

This letter confirms compliance of provided Filament Wound Fiberglass Pipe per ASTM D-2996-88 standard specification for Filament Wound "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin Pipe) for project use. Though specification ASTM D2996 limits the scope of supply to 16" diameter in size, this specification may be applied to larger sizes where table 2 Physical Property Requirement designation 4 of apparent stiffness would have values different than those listed.

The following filament wound pipe classification is certified per ASTM D2996 by this submission:

RTRP 12EU1-311X (Free Ended Closures)
RTRP 12EW2-311X (Restrained End Closures)

Notes concerning classification digits:

1	Type - Filament Wound
2	Grade 2 - Glass Fiber Reinforced Polyester Resin Pipe
E	Class E - Polyester Resin Liner (reinforced)
1	Free End (Pipe subject to axial end load by end closures)
2	Restrained End (Test Fixture ends react axial pressure load)
U	Static Test Procedure B - Free End hoop stress min 12,500 psi (Testing = 12,500 psi)
W	Static Test Procedure B - Restrained End hoop stress min 16,000 psi (Testing = 16,000 psi)
3	Table 2 Designation Order 1 - short term rupture strength tensile stress min 40,000 psi (Testing = 40,000 psi)
1	Table 2 Designation Order 2 - longitudinal strength tensile stress min 8,000 psi (Testing = 9,000 psi)
1	Table 2 Designation Order 3 - longitudinal tensile modules of elasticity min 1,000,000 psi (Testing = 1,300,000 psi)
W	Table 2 Designation Order 4 - Apparent Stiffness Factor (SF) For resistance to diametrical deflection at 5% deflection minimum 3.16 in2 Value will vary by actual pipe wall thickness and diameter size For 16" diameter 100 psi pipe at 0.26" nominal wall thickness with a 0.10" liner: The minimum apparent stiffness (SF) is determined by: SF = EI = 3300 in3 lbf/in2

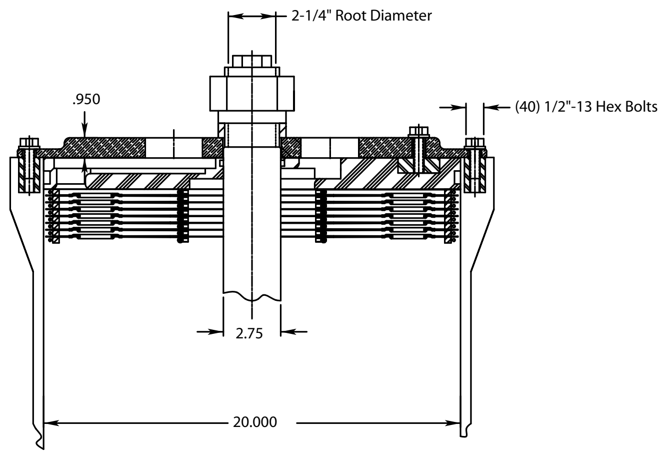
Summary of the Design:
The FRP (Fiberglass Reinforced Plastic) housings are used as enclosures for a pressure filtration membrane system component. Elastomeric seals retain the pressure of the liquid and the modules has one inlet and two outlets for process liquid. Design calculations have been validated through developmental pressure testing to 1000 psi stress testing under actual conditions. Further verification has come from actual onsite use by more than 140 customers operating at pressure between 60 psi and 550 psi.

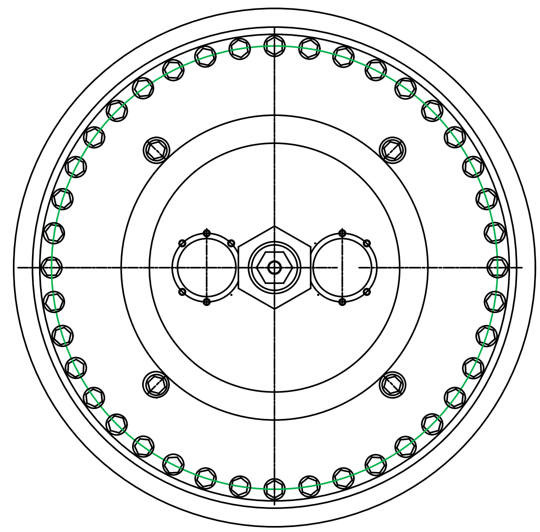
V✧SEP®

NLR doc. 334-91

New Logic Research, Inc
1295 67th Street
Emeryville, CA 94608
510-655-7305
info@vsep.com (e-mail)
http://www.vsep.com

V✧SEP Filter Pack: Center Bolt Pressure Rating Calculation





Pressure Design Conformance:

The V✧SEP Filter Pack is made using a FRP (Fiberglass Reinforced Plastic), housing which is bonded to stainless steel trays spaced about 1/4" apart to form a monolithic module. the largest unsupported open area is 1/4" thick.

There is an upper and lower Steel Plate that retains the liquid and supports a plastic end plate equipped with o-ring piston seals. A 2-1/2" "Center Bolt is used to hold down the Filter Pack and also acts to retain the pressure exerted on it.

The End Plate Pressure Rating is determined by:

PC =

Where: PC = Pressure Class
p = 3.14
P = Operating Pressure of the Filter Pack
A_1 = Area subject to Pressure
A_2 = Root Cross Section Area of the Center Bolt
PA_1 = Force
FS = 2 (per Project Design, could be 1.8)
Dr = Root Diameter of Bolt
Ut = Ultimate Tensile Strength of Bar

Solve for A_1:

$A_1 = p \times r^2 = 3.14 \times 10^2 = 3.14 \times 100 = 314$ square inches

Solve for A_2:

$A_2 = p \times r^2 = 3.14 \times 1.125^2 = 3.14 \times 1.26 = 3.97$ square inches

Solve for Applied Stress

Force ÷ Area = $PA_1 \div A_2$ = 350 psi x 314 si ÷ 3.97 si = 27,682 psi

Solve for Safety Factor at 350 psi

Ut ÷ Applied Stress = 180,000 psi ÷ 27,682 psi = 6.5x Overdesign

Solve for Yield Pressure

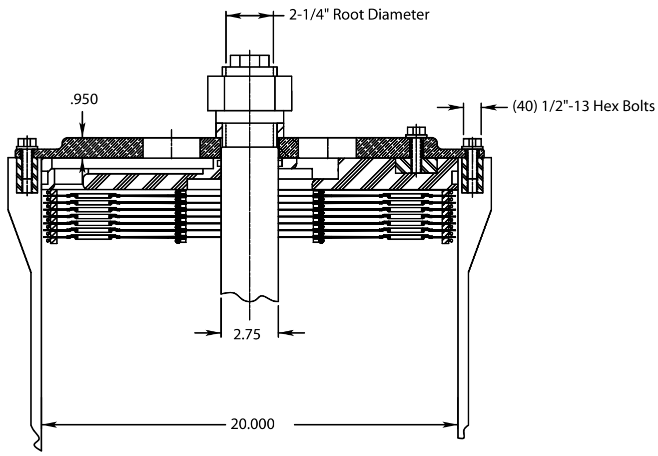
$A_2 \div A_1 \times$ Ut = 3.97 si ÷ 314 si x 180,000 psi = 2,275 psi

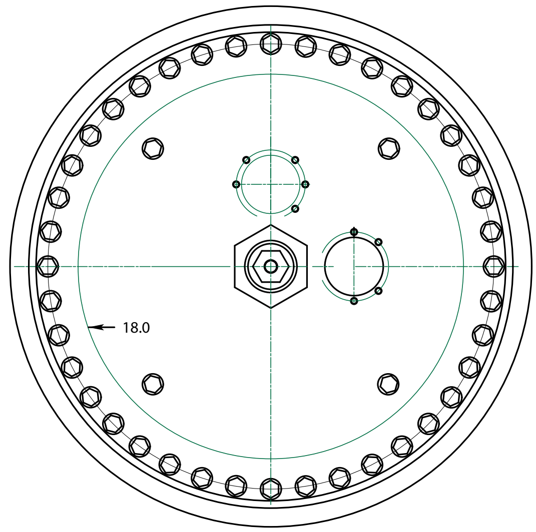
The maximum pressure rating for Center Bolt is 2275 psi

Note:Calculations assume no effects of perimeter bolts

Tolerances Unless Otherwise Indicated: x/x -> ± 1/16" .x -> ± .100 .xx -> ± .030 .xxx -> ± .005 x° -> ± 30°	REVISION	NEW LOGIC RESEARCH, INC. 84" Filter Pack D Scale - i-408-CBPR A 10/15/01 B. Culkin G. Johnson

V✧SEP Filter Pack: End Plate Pressure Rating Calculation





Pressure Design Conformance:

The V✧SEP Filter Pack is made using a Steel Retaining plate for connection of the upper plumbing. The material used is 17-4 pH Stainless Steel and is heat treated to 180 ksi Ultimate Tensile strength.

There is an upper and lower Steel Plate that retains the liquid and supports a plastic end plate equipped with o-ring piston seals. A 2-1/2" "Center Bolt is used to hold down the Filter Pack and also acts to retain the pressure exerted on it.

The End Plate Pressure Rating is determined by:

Given:
- ı = 3.14
- w = Operating Pressure of the Filter Pack
- R = OD Radius
- S_{m1} = Maximum Applied Stress @ 1" thick
- S_{m2} = Maximum Applied Stress @ 1/2" thick
- t = Thickness of steel
- k = Correction Factor (per Marks Engineering Guide)
- Dr = Root Diameter of Bolt
- Ut = Ultimate Tensile Strength of Bar

Solve for S_{m1}:

$$S_{m1} = k \frac{w \times R^2}{t^2} = 1.59 \frac{350 \times 9^2}{.950^2} = 49{,}946 \text{ psi}$$

Solve for S_{m2}:

$$S_{m2} = k_1 \frac{w \times R^2}{t^2} = .122 \frac{350 \times 10^2}{.50^2} = 17{,}080 \text{ psi}$$

Note:Formula is taken from Marks' Standard Handbook for Mechanical Engineers 10th Edtition Section 5-48

Solve for Safety Factor:

The Safety Factor is determined by dividing the applicable material property, Ultimate Tensile Strength, by the actual applied stress.Factors of Safety account for uncertainties with regard to use. Normal Safety Factors for design purposes are between 1.5 and 5.0

Solve for Safety Factor at 350 psi in the 0.950" thick Section

Ut ÷ Applied Stress = 180,000 psi ÷ 49,946 psi = 3.6x Overdesign

Solve for Safety Factor at 350 psi in the 0.50" thick Section

Ut ÷ Applied Stress = 180,000 psi ÷ 17,080 psi = 10.5x Overdesign

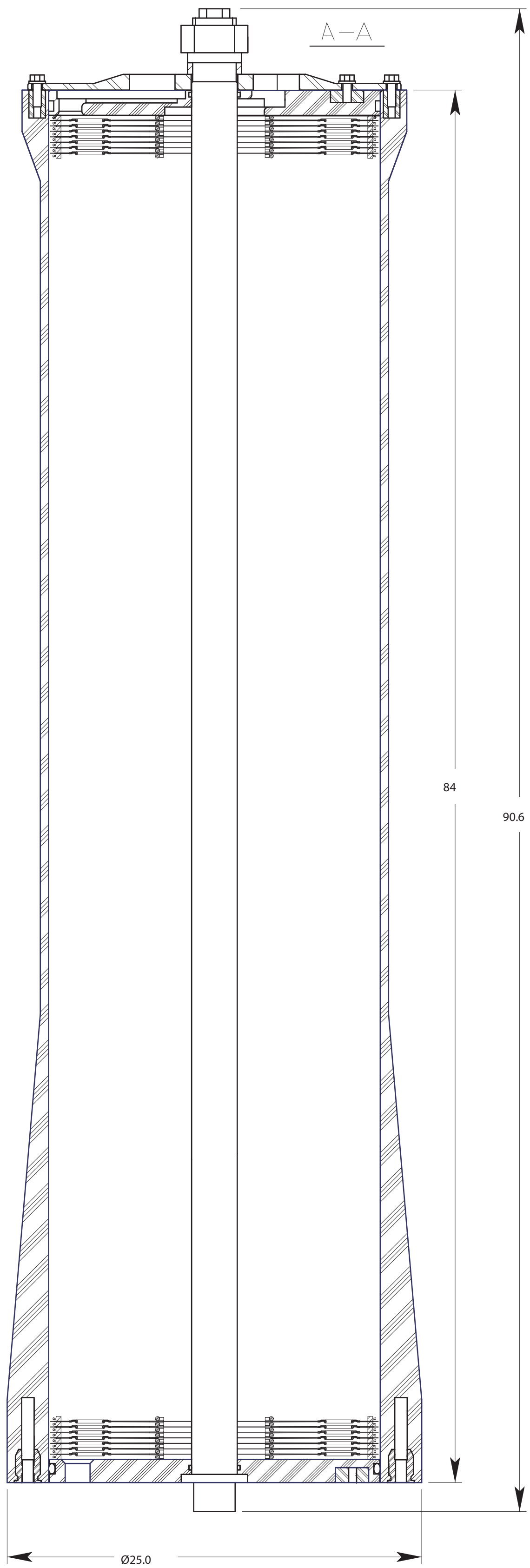
Solve for Burst Pressure

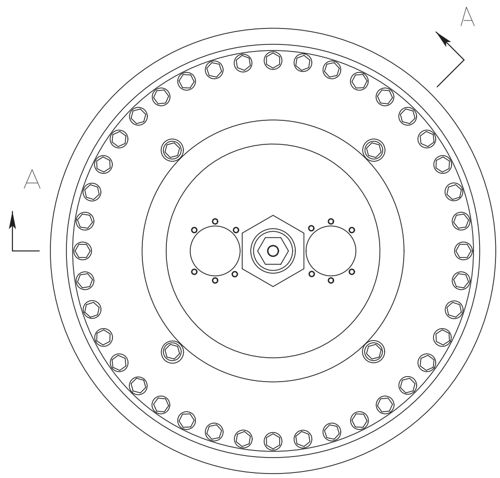
$$w = \frac{U_t \times t^2}{k \times R^2} = \frac{180{,}000 \times 950^2}{1.59 \times 9^2} = 1{,}261 \text{ psi}$$

The Steel End Plate is capable of withstanding 1,261 psi

Tolerances Unless Otherwise Indicated: x/x -> ± 1/16"; .x -> ± .100; .xx -> ± .030; .xxx -> ± .005; x° -> ± 30°	REVISION	NEW LOGIC RESEARCH, INC.			
		84" Filter Pack			
		D	Scale -	i-408-EPPR	A
		10/15/01	B. Culkin	G. Johnson	

V-SEP Filter Pack: Pressure Rating Calculation





Pressure Design Conformance:

The VSEP Filter Pack is made using a FRP (Fiberglass Reinforced Plastic), housing which is bonded to stainless steel trays spaced about 1/4" apart to form a monolithic module. the largest unsupported open area is 1/4" thick.

The FRP pipe is designed and manufactured in accordance with the requirements of ASTM D2996. The pipe is based on a design life of 50 years based on ASTM D2992 Procedure B. The design pressure rating is calculated based on data from ASTM 2992 and is based on a minimum wall thickness of .75"

The FRP pipe is designed with 45º filament hoop wound glass fibers and 8084 Dow Derekane® vinyl ester resin. The following calculation is for the FRP pipe only and does not add any pressure rating strength for the bonding of steel reinforcing trays spaced every 1/4"

The Long Term Pressure Rating is determined by:

$$PC = \text{Lths} \times \text{Tks} \times \frac{2}{FS} \times \frac{1}{D_m}$$

Where:
- PC = Pressure Class
- Lths = 12,500 psi (Free End) or 16,000 psi (Restrained End)
- Tks = Minimum Wall Thickness (Inches)
- FS = 2 (per Project Design, could be 1.8)
- D_m = Mean Diameter

Solve for Pressure Rating:

$$PC = 16{,}000\text{ psi} \times 1.2" \times \frac{2}{2} \times \frac{1}{20.75"}$$

$$PC = 12{,}000 \times 1.2 \times 0.04819$$

$$PC = 925\text{ psi}$$

The design pressure rating for VSEP Filter Packs is 925 psi

NLI doc 334-90

Tolerances unless otherwise indicated:
x/x -> ±1/32
.x -> ±.100
.xx -> ±.030
.xxx -> ±.005
x° -> ±30'

REVISION

NEW LOGIC

84" Filter Pack

D | Scale – | i-408 | A

10/11/97 | B.CULKIN | G Johnson

NLR Welding Procedures

GMAW (Mig) Procedure for Structural Carbon Steel

Powcon Mig machine set for short circuit welding – 75% Argon, 25% Carbon Dioxide gas shield

AWS A5.18, ASME SEA 5.18 ER 705-3

.035 Electrode wire, Lincolon L-50

Structural parts are fit and tacked into place according to print specs and tolerance. They are then finish welded using single and multiple pass weld applications. Sections of work are stress relieved as per engineering requirements. Finish work is then sanded and cleaned for powdercoating.

GTAW (Tig) Procedure for SS Piping

Lincoln Square Wave Tig 350 Machine

100 % Argon gas shield and Argon back gas purge. Type ER 316L SS Rod

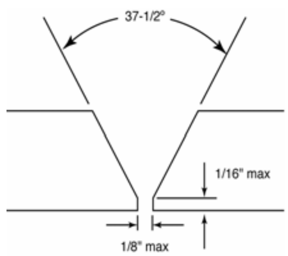
Pipe sections are fit up using tack and bolt up procedures. Sections are then mocked up and assembled on the skid to check for fit and alignment. After approval they are then disassembled and finish welded using fillet and multiple pass weld process. Sections of work are stress relieved as per engineering requirements. All work is brush cleaned and prepared for electro-polish.

MIG Welding Specification

V-SEP Membrane Filtration System	Spec No.		MIG-001
New Logic, 1295 67th Street, Emeryville, CA 94		Date	4/14/2006
		Sheet	1 of 1

Project:	**NLR Approved by**	
	New Logic	Greg Johnson
	New Logic	Kevin Neeley
Client Info	**Client Approved by:**	

Groove Design Used



Base Metal	
Material Specification	SA 53
Type or Grade	**A36 Carbon**
	p No.1 to p No. 1
Thickness	.12 w
Diameter	N/a
Other:	

Filler Materials		**Position**	
Weld Metal Analysis A N	1	Position of Groove	6G
Size of Electrode	0.035	Weld Progression	Uphill
Filer Metal F No.	6	Other:	
SFA Specification	5.18		
AWS Classification	E 70S-3		
Other	n/a		
Post Weld Treatment		**Gas**	
Temperature	n/a	Type of Gas or Gases	Argon/Carbon Dioxide
Time		Gas Mixture	75%/25%
Other		Other:	
Electrical Characteristics		**Technique**	
Current	D.C.	String or Weave Bead	String
Polarity	Reverse	Oscillation	n/a
Amps	190	Multiple or Single Pass	Mulitple
Volts	29	Single or Multiple Electr	Single
		Travel Speed	10"/min

Approved By:	Greg Johnson	**Date:**	4/14/2006
Print Name		**Company:**	

TIG Welding Specification

TIG Welding Specification		**Spec No.**	**TIG-001**
V-SEP Membrane Filtration System		Date	4/14/2006
New Logic, 1295 67th Street, Emeryville, CA 94		Sheet	1 of 1
Project:		**NLR Approved by**	
		New Logic	Greg Johnson
		New Logic	Kevin Neeley
Client Info		**Client Approved by:**	
Groove Design Used		**Base Metal**	
		Material Specification	SA 312
		Type or Grade	**TP 304**
		P No. 8	to p No. 8
		Thickness	Schedule 40 & 80
		Diameter	1" to 4"
		Other:	
Filler Materials		**Position**	
Weld Metal Analysis A N	8	Position of Groove	6G
Size of Electrode	3/16" to 3/32"	Weld Progression	Uphill
Filer Metal F No.	6	Other:	
SFA Specification	5.9		
AWS Classification	ER 308		
Other	ER 316L		
Post Weld Treatment		**Gas**	
Temperature	n/a	Type of Gas or Gases	Argon
Time		Gas Mixture	100%
Other		Other:	
Electrical Characteristics		**Technique**	
Current	D.C.	String or Waeve Bead	String
Polarity	Straight	Oscillation	None
Amps	75/100	Multiple or Single Pass	Mulitple
Volts	20/30	Single or Multiple Electr	Single
		Travel Speed	
Prepared By:	Greg Johnson	Date:	4/14/2006
Approved By:		**Date:**	
Print Name		**Company:**	

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Victor Freeman   Identification No.

Test Description

Identification of WPS followed: B31.3 (a-c)   ☐ Test Coupon   ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L   Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1: .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1: N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A   Length and percent of defects

Macro examination (QW-184): N/A   Fillet size (in): N/A   Concavity/convexity (in): N/A

Other tests

Film or specimens evaluated by: Bruce Sherman   Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman   Laboratory test no.: 10-005

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/10/2010   By:

AWS
BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB13055

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Ramon Moreno Identification No.:

Test Description

Identification of WPS followed: B31.3 (a-c) ☐ Test Coupon ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1:___ .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1:___ N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A Length and percent of defects:

Macro examination (QW-184): N/A Fillet size (in): N/A Concavity/convexity (in): N/A

Other tests:

Film or specimens evaluated by: Bruce Sherman Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman Laboratory test no.: 10-006

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/112/2010 By:

BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB 13055

FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)
(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welders Name: Victor Freeman   Identification No.

Test Description

Identification of WPS followed: B31.3 (a-c)   ☐ Test Coupon   ☐ Production Weld

Specification of base metal(s): SA 312 Type 316L   Thickness: .276" 2.5" sch. 80

Testing Conditions and Qualification Limits

Welding Variables (QW-350)	Actual Values	Range Qualified
Welding process(es)	GTAW	GTAW
Type (i.e. manual, semi-auto) used	manual	
Backing (metal, weld metal, double-welded, etc.)	no backing	with or w/out backing
☐ Plate ☑ Pipe (enter diameter if pipe or tube)	2.875	1' to unlimited
Base metal P- or S-Number to P- or S-Number	P8 to P8	P1 thru P11
Filler metal or electrode specification(s) (SFA)(info only)	SFA 5.9	
Filler metal or electrode specification(s) (info only)	ER316L	
Filler metal F-Number(s)	6	6
Consumable insert (GTAW or PAW)	N/A	
Filler type (solid/metal or flux/ cored/powder) (GTAW or PAW)	solid metal	solid metal only
Deposit thickness for each process		
Process 1: .276" ☑ Yes ☐ No	.276"	.062" to .554"
Process 1: N/A ☐ Yes ☐ No	N/A	
Position qualified (2G, 6G, 3F, etc.)	6G	All positions
Vertical progression (uphill or downhill)	Uphill	Uphill only
Type of fuel gas (OFW)	N/A	
Inert gas backing (GTAW, PAW, GMAW)	Ar 100%	
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	

RESULTS

Visual Examination of Completed Weld (QW-302-4): Acceptable

☑ Bend test: ☑ Transverse root and face {QW-462.3(a)}; ☐ Longitudinal root and face {QW-462.3(b)} ☐ Side (QW-462.2);
☐ Pipe bend specimen, corrosion-resistant overlay {QW-462.5(c)}; ☐ Plate bend specimen, corrosion-resistant overlay {QW-462.5(d)};
☐ Macro test for fusion {QW-462.5(b)}; ☐ Macro test for fusion {QW-462.5(e)};

Type	Result	Type	Result	Type	Result
Root	Pass	Root	Pass		
Face	Pass	Face	Pass		

Alternative radiographic examination results (QW-191): N/A

Fillet weld - fracture test (QW-180: N/A   Length and percent of defects

Macro examination (QW-184): N/A   Fillet size (in): N/A   Concavity/convexity (in): N/A

Other tests

Film or specimens evaluated by: Bruce Sherman   Company: Bruce Sherman SCWI

Mechanical tests conducted by: Bruce Sherman   Laboratory test no.: 10-005

Welding supervised by: Matt Ayers

We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements of Seciton IX of the ASME Boiler and Pressure Vessel Code.

Organization: New Logic Research

Date: 2/10/2010   By: [signature]

AWS
BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Bruce Sherman
NB13055

WELDING PROCEDURE SPECIFICATION (WPS) ☑ Yes

PREQUALIFIED NO **QUALIFIED BY TESTING** YES

or PROCEDURE QUALIFICATION RECORDS (PQR) ☐ Yes

Identification # GMAW-S-2

Revision 0 Date ####### By B. Sherman

Authorized by M. Ayers Date 2/11/2010

Type-- ☐ ManualYe ☑ Semi-Automatic ☐ Machine ☐ Automatic

Company Name New Logic Research Inc.

Welding Process(es) GMAW-S

Supporting PQR No.(s) GMAW-S-2

JOINT DESIGN USED

Type: Tee Joint

☑ Single ☐ Double W

Backing ☑ Yes ☐ No

Backing Material Base Metal

Root Opening 0" Root Face Dim. N/A

Groove Angle N/A Radius (J-U) N/A

Back Gouging ☐ Yes ☑ No Method

BASE METALS

Material Spec All Group 1(Table 3.2)

Type or Grade

Thickness Groove N/A Fillet 1/8"- 1/2"

Diameter (Pipe) All

FILLER METALS

AWS Specification A5.18

AWS Classification ER70S-3

SHIELDING

Flux

Gas Ar-CO2

Comp. 75-25%

Electro-Flux (Class)

Flow Rate 40cfh

Gas Cup Size

PREHEAT

Preheat Temp. Min. 32 deg. F

Interpass Temp. Min. 32 deg. F Max. 600 deg. F

POSITION

Position of Groove N/A Fillet 1F, 2F

Vertical Progression y☐ Up ☐ Down

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW) ☑ Short-Circuiting ☐ Globular ☐ Spray

Current ☐ AC ☑ DCEP ☐ DCEN ☐ Pulsed

Other

Tungsten Electrode (GTAW) N/A

Size

Type

TECHNIQUE

Stringer or Weave Bead Stringer

Multi-pass or Single Pass (per side) Single

Number of Electrodes 1 Longitudinal N/A

Lateral N/A

Angle N/A

Contact Tube to Work Distance 1/4-1/2"

Peening none

Interpass Cleaning none

POSTWELD HEAT TREATMENT None

Temp.

Time

WELDING PROCEDURE

Pass or Weld Layers	Process	Filler Metals: Class	Filler Metals: Diam.	Current: Type & Polarity	Current: Amps or Wire Feed Speed	Volts	Travel Speed	Joint Details
1- all	GMAW	ER70S-3	.035"	DC+	420 ipm	22	10 ipm	Tee Jt.

WELDING PROCEDURE SPECIFICATION (WPS) ☑ Yes

PREQUALIFIED NO **QUALIFIED BY TESTING** YES

or PROCEDURE QUALIFICATION RECORDS (PQR) ☐ Yes

Identification # GMAW-S-2

Revision 0 Date ####### By B. Sherman

Company Name: New Logic Research Inc.
Welding Process(es): GMAW-S
Supporting PQR No.(s): GMAW-S-2

Authorized by M. Ayers Date 2/11/2010

Type-- ☐ ManualYe ☑ Semi-Automatic ☐ Machine ☐ Automatic

JOINT DESIGN USED

Type: Tee Joint

☑ Single ☐ Double W

Backing ☑ Yes ☐ No

Backing Material: Base Metal

Root Opening: 0" Root Face Dim.: N/A

Groove Angle: N/A Radius (J-U): N/A

Back Gouging ☐ Yes ☑ No Method

POSITION

Position of Groove: N/A Fillet: 1F, 2F

Vertical Progression y☐ Up ☐ Down

ELECTRICAL CHARACTERISTICS

Transfer Mode (GMAW) ☑ Short-Circuiting ☐ Globular ☐ Spray

Current ☐ AC ☑ DCEP ☐ DCEN ☐ Pulsed

Other

Tungsten Electrode (GTAW) N/A

Size

Type

BASE METALS

Material Spec: All Group 1(Table 3.2)

Type or Grade

Thickness: Groove N/A Fillet 1/8"- 1/2"

Diameter (Pipe): All

FILLER METALS

AWS Specification: A5.18

AWS Classification: ER70S-3

TECHNIQUE

Stringer or Weave Bead: Stringer

Multi-pass or Single Pass (per side): Single

Number of Electrodes: 1 Longitudinal N/A

Lateral N/A

Angle N/A

Contact Tube to Work Distance: 1/4-1/2"

Peening: none

Interpass Cleaning: none

SHIELDING

Flux

Gas: Ar-CO2

Comp.: 75-25%

Electro-Flux (Class) Flow Rate: 40cfh

Gas Cup Size

PREHEAT

Preheat Temp. Min.: 32 deg. F

Interpass Temp. Min.: 32 deg. F Max.: 600 deg. F

POSTWELD HEAT TREATMENT None

Temp.

Time

WELDING PROCEDURE

Pass or Weld Layers	Process	Filler Metals: Class	Filler Metals: Diam.	Current: Type & Polarity	Current: Amps or Wire Feed Speed	Volts	Travel Speed	Joint Details
1- all	GMAW	ER70S-3	.035"	DC+	420 ipm	22	10 ipm	Tee Jt.

PROCEDURE QUALIFICATION RECORD (PQR) # GMAW-S-2

Test Results

TENSILE TEST N/A

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load, lb	Ultimate Unit Stress, psi	Character of Failure and Location

GUIDED BEND TEST N/A

Specimen No.	Type of Bend	Result	Remarks

VISUAL INSPECTION

Appearance: Acceptable
Undercut: None
Piping porosity: None
Convexity: Acceptable
Test date: 2/20/2010
Witnessed by: Matt Ayers

Radiographic-ultrasonic examination N/A
RT report no.: ______ Result ______
UT report no.: ______ Result ______

FILLET WELD TEST RESULTS

Minimum size single pass — Macro etch
1 Pass 3 Pass
2 Pass

Minimum size mulitple pass — Macro etch
1 N/A 3 N/A
2 N/A

Other Tests

All-weld-metal tension test: N/A
Tensile strength, psi: N/A
Yield point/stregth, psi: N/A
Elongation in 2 in. %: N/A
Laboratory test no.: 10-008

Welder's name: Ramon Moreno Clock no. ______ Stamp no. ______
Tests conducted by: Bruce Sherman Laboratory: Bruce Sherman SCWI
Test number: 10-008
Per: 4.2

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Section 4 of AWS D1.1/D1.1M 2008 (year) Structural Welding Code-Steel

Signed: New Logic Research Inc.
Manufacturer or Contractor

By: [signature]
Title: Plant Manager
Date: 2-23-10

WELDER, WELDING OPERATOR, OR TACK WELDER QUALIFICATION TEST RECORD

Type of Welder: Welder

Name: Victor Freeman   Identification No.:

Welding Procedure Specification No.: GMAW-S-1   Rev: 0   Date: 2/20/2010

Variables	Record Actual Values Used in Qualification	Qualification Range
Process/Type [Table 4.12, Item (1)]	GMAW-S	GMAW-S
Electrode (single or multiple) [Table 4.12, Item (7)]	Single	Single
Current Polarity	DC Rev	
Position [Table 4.12, Item (4)]	2F	1F,2F
Weld Progression [Table 4.12, Item (5)]	Backhand	Backhand only
Backing (YES or NO) [Table 4.12, Item (6)]	Yes	
Material Spec.	A-36 to A-36	All M-1 matl.
Base Metal		
Thickness (Plate)	1/2"	Unlimited
Groove	N/A	
Fillet	5/16"	All Sizes
Thickness (Pipe/Tube)	N/A	
Groove	N/A	
Fillet		All T
Diameter (Pipe)	N/A	
Groove	N/A	
Fillet	N/A	All Diameters
Filler Metal (Table 4.12)		
Spec. No.	5.18	
Class	ER70S-3	ER70S-X
F-No. [Table 4.12, Item (2)]	6	6
Gas/Flux Type (Table 4.12)	Ar 75%-CO2 25%	
Other		

VISUAL INSPECTION (4.8.1)

Acceptable YES OR NO: Yes

Guided Bend Test Results (4.30.5)

Type	Result	Type	Result

Fillet Test Results (4.30.2.3 and 4.30.4.1)

Appearance: Acceptable   Fillet Size: 5/16"

Fracture Test Root Penetration: Full to root   Macroetch: Acceptable

(Describe the location, nature, and size of any crack tearing of the specimen.)

Inspected by: B.Sherman   Test Number: 10-009

Organization: Bruce Sherman SCWI   Date: 2/20/2010

RADIOGRAPHIC TEST RESULTS (4.30.3.2)

Film Identification Number	Results	Remarks	Film Identification Number	Results	Remarks

BRUCE S. SHERMAN
SCWI 99100068
QC1 EXP. 10/01/11

Interpreted by: Test Number:

Organization: Date:

Bruce Sherman

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in conformance with the requirements of Section 4 of AWS D11.1/D1.1M 2008 (year) Structural Welding Code-Steel

Manufacturer or Contractor: New Logic Research   Authorized by: Matt Ayers

Date: ## 2/20/10   2-23-10

NEW LOGIC INTERNATIONAL
1295 67th Street, Emeryville, California U.S.A 94608 (510) 655-7305 fax-(510) 655-7307

Epoxy Powdercoating Procedures

1. Part will arrive at vendor's shop clean and free of grease or machine oil.

2. Sandblast part using 0.060" garnet aluminum oxide media. Complete coverage is required. White Metal.

3. Part is to be preheated in preparation to receive coating. Preheating will be at 400°F for approximately 60-90 minutes. Heating time is proportional to the mass of the part. Check part readiness with non-contact thermometer gun for 400°F.
   DO NOT EXPOSE TO HEAT OVER 450°F.

4. ASA-61 Gray Epoxy coating will be sprayed onto the part. Uniform thickness of 0.010" is required.

5. General inspect for thickness, uniformity of coverage, or defects (i.e. pinholes)

6. Part will be cured in an oven at 400°F for a period of time sufficient to complete the curing process of the coating.

7. Inspect for complete cure with MEK rag wipe.

8. Allow part to sufficiently cool. Call New Logic for pick-up.

These procedures are to be followed without exception. Each part will arrive with a document which will need to be signed verifying that all of the procedures and inspections listed above have been performed and passed.

NEVER HEAT THESE PARTS ABOVE 450°F UNDER ANY CIRCUMSTANCE.

Upon returning to New Logic, each part will be tested as follows:

1. Hardness test
2. Thickness test
3. MEK Rag Wipe Cure test

Accepted by: [signature] New Logic International [signature] Poly Engineering

Technical Information Sheet

ALESTA®
Powder Coatings

NUMBER: *EFH400S9* *JULY 15, 1997*
NAME: *ASA 61 GRAY* *TYPE:* Epoxy

POWDER PROPERTIES

ASTM D5965-96, C	Specific Gravity	1.6 ± 0.05
	Theoretical Coverage	120 ft^2/lb/mil
ASTM D3451-92, 13	Mass Loss During Cure	< 1%
	Maximum Storage Temp.	75 °F

COATING PROPERTIES

ASTM D523-89	Gloss at 60°	82+
DPC TM 10.219	PCI Powder Smoothness	6
ASTM D2454-95	Overbake Resistance, Time	100%
ASTM D3363-92a	Pencil Hardness	3H-4H
ASTM D2794-93	Dir / Rev Impact, Gardner	160 / 160 in/lbs
ASTM D3359-97	Adhesion, Cross Hatch	5B Pass
ASTM D522-93a	Flexibility, Mandrel	1/8 in. dia., no fracture
ASTM B117-97	Salt Spray	1,000 hrs
UL DTOV2 Organic Coating	Steel Enclosures, Elect. Eq.	Recognized
Chrysler MS-PE16-2	Underbody	Pass

APPLICATION

Electrostatic Spray, Cold
Substrate: 0.032 in. CRS
Pretreatment: Bonderite® 1000, Parcolene® 60

CURE SCHEDULE:
(Time at substrate temperature)
8 Minutes @ 400°F

FILM THICKNESS: 2.0-2.5 Mils

This product is authorized for use on submarine components having a maximum use temperature of 125°F. This product is close in color to American National Standards, ANSI 61.

Prepared 4/23/2003

9800 Genard Rd. Houston, TX 77041-7624 1-800-247-3886 fax: 713-939-4027
4130 Lyman Ct. Hilliard, OH 43026-1213 1-800-667-9610 fax: 614-771-4139

POWDER COATED TOUGH ISO 9001

DUPONT
The miracles of science

Revision By D.S.M.

Specification Number Approved R.S.D.
007
Revised 5-1-93

MANUFACTURING PROCESS SPECIFICATIONS

Scientific Platers Specification on S.P.I. Processing (Chemical Purity of Metal)

I. DESCRIPTION

1. INTRODUCTION

1.1 Scope and Application

This specification covers the requirements for surface treatment of metals by S.P.I. Processing in which the parts to be cleaned or polished are made anodic in the Power-Kleen electrolyte solution and cleaning or polishing is accomplished by the removal of the amorphous, thermal stressed skin on all metals, which is the base of contamination.

1.2 S.P.I. Processing may be used when improved RMS surface finish, surface decontamination, sizing and deburring, reduced friction and/or greater corrosion resistance is required.

(a) Pre-Weld, Pre-Braze and Pre-Solder conditioning of surfaces.

(b) Surface stresses and strains removal.

(c) Galling elimination of threaded parts.

(d) Mercury and Hydrogen purging.

(e) Non destructive inspection; detection of: mal-heat treat and anneal in 17-4PH, 17-7PH, and 400 series stainless steel; of carburization in 200 and 300 series stainless steel; undesirable chemical changes of INCONELL X which occurs through introduction of titanium, aluminum and molybdenum in oven aging; of high carbon content or non-compatible alloys; of chromium carbide condition in 300 series stainless steel.

(f) Increase adhesion of plating and other coatings up to 300%.

(g) Completely compatible with atomic fuels, i.e., hydrogen peroxide, liquid oxygen, fuming nitric acid, fluorine, etc.

1.3 S.P.I. Processing in conformance to this specification may be performed on corrosion resistant steel alloys, heat resistant steel alloys, and high temperature alloys containing 12% or more chromium. Alloys other than these must have the approval of Metallurgical Department.

1.4 Under no circumstances can any parts be processed in an electrolyte solution containing hydros, nitros, halogens, chromics or organics. Such solutions create an ionization of destructive nature to weldments and parent metal causing intergranular attack.

II APPLICATION

The application of this specification is limited to the metals for which there is Confidential Supplement* to describe the method of processing. Other metals shall not be subjected to S.P.I. Processing without prior approval of the Metallurgical Department.

This process may be used whenever the following conditions are desired:

(a) High luster polished surface - Stock metal removed usually 0.0001 to 0. 0003; however, metal removed may be controlled and hold concentricity from 50 millionths of an inch up to the ± tolerance size according to Engineering requirements.

(b) Matte finish - obtained by glass bead honing followed by light S.P.I. Processing or by otherwise varying the S.P.I. Process.

(c) Corrosion Resistance - Stainless steels (300 Series) exhibit high degree of passivation exceeding requirements of Mil. S-5002. (Excess of 3000%)

(d) Chemically pure and surgically clean surface - May be used for LOX clean refer to Confidential Supplement* for handling procedure or prior to LOX cleaning.

III LIMITATIONS

(a) Aluminum alloys (See Alumpure processing).

(b) Assemblies with faying surfaces except with concurrence of applicable Manufacturing Specifications.

(c) Special tooling required for parts with deeply recessed areas.

(d) Parts with close tolerances except when the maximum allowable amount of metal removed is specified.

IV S.P.I. PROCESSING PROCESS

4.1 Type I - High luster, bright polish, stock removal .0001 to .001 inches for machined surfaces.

4.1.A Type I-A - Raw castings - Removal of casting skin, stock removal 0.001 to 0.003 per surface.

4.2 Type II - S.P.I.-etch - matte finish as a base for further processing obtained by grit blasting or honing followed by a light S.P.I. Process.

4.3 Type III - Burr removal - Stock removal of .00005 to .00015 measured on an externally machined surface.

4.4 Type IV - Reverse plating - for improved wear properties after grinding or honing or plated coatings. No measurable dimensional change is allowable.

4.5 Type V - Bright polish on welded assemblies; stock removal 0.0001 to 0.0005.

4.6 Type I parts shall have a smooth, high luster, uniformly-bright surface. 200 Series, 300 Series, 21-6-9 414 and 431 steels and precipitation hardenable alloys shall be capable of passing 48 hours of salt spray testing per QQ-M-151.

4.7 Type II shall have a matte finish, uniformly high luster. Type II parts shall be capable of passing 48 hours of salt-spray testing per QQ-M-151.

V PROCESS

5.1 Prior to S.P.I. Process, parts shall be cleaned free of contaminants, scale or other adherent materials. Cleaning may be accomplished by any applicable method which will produce clean parts, but not affect them chemically or physically. Pickling on steels subject to inter-granular corrosion is specifically prohibited (PH steels, AM-350, AM-355, 17-7, 17-4, 15-7, moly, 718, inconell and refractory metals)

5.2 Areas not to be S.P.I. Processed may be masked.

5.3 Temperature control of Power-Kleen solution must not exceed 175° F.

5.4 Rinsing operations shall be complete. Residual acids or other process solution chemicals shall not be left on components.

5.5 S.P.I. processed parts shall exhibit inactive surfaces unless an active surface is required and stated on the applicable Purchase Order.

5.6 S.P.I. Processing may be accomplished by an applicable process provided the finished product meets the quality requirements of this specification.

VI QUALITY ASSURANCE

6.1 To assure adequate performance characteristics, vendor's capability shall be approved by purchaser before material for production is treated.

6.1.1 Purchaser will supply test samples approximately 0.25x1x6 inches of 17-4 PH steel machined to 100-125 R. M. S. finish on all surfaces. Vendor shall S.P.I. Process test specimens and submit to purchaser's quality control for approval.

6.1.2 Test specimens shall be inspected for a bright appearance and for absence of any surface imperfections, pitting, resulting from the cleaning or polishing operation. Specimens shall be subjected to 8 hour oxygenated water corrosion test. Any evidence of corrosion visible to the unaided eye shall be cause for rejection.

VII INSPECTION

Parts shall be inspected for dimensions and smoothness specified on the engineering drawing and conformance with quality requirements.

NEW LOGIC
RESEARCH, INC.

CE EC Declaration of Conformity

This letter confirms compliance of the VSEP Membrane Filtration Equipment with the European Community directives for CE marking. The listed product models below were tested and determined to be in compliance with all applicable directives, provided that they are used according to our Advisory Technical File dated 7-1-2009.

CE directive classifications:	2004/108/EEC (Electromagnetic compatibility) 2006/95/EEC (Safety/Low Voltage) 2006/42/EC (Machinery)
Standards:	EN 61000-6-2 : 2005 EN 60730
Manufacture:	New Logic Research, Inc 1295 67th Street Emeryville, CA 94608 510-655-7305 info@vsep.com (e-mail) http://www.vsep.com
Models:	VSEP Series I, Series P-50, Series LP, RotoSep50, RotoSep4 S-255, S-850, S-1600, S-3200, S-7200, S-18000, S-36000
Year:	2010
Place:	Emeryville, CA, USA
Signature:	
Full Name:	Gregory Johnson
Position:	CEO

V*SEP

NLR doc. 334-91
V*SEP is a registered trademark
Patents pending

Intertek ETL SEMKO

CLASSIFICATION AUTHORIZATION TO MARK

This authorizes the application of the Certification Marks shown below to the models described in the Products(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to the multiple listee model(s) identified on the correlation page of the Listing Report.

Applicant: *New Logic Research Inc.*
1295 67th Street
Emeryville, CA 94608, USA

Contact: Name: *Greg Johnson* Phone: *(510) 655-7305*
Fax: *(510) 655-7307*

Manufacturer: *New Logic Research Inc.*
1295 67th Street
Emeryville, CA 94608, USA

Party Authorized To Apply Mark: *Same as Manufacturer*

Report Issuing Office: *Intertek, 1365 Adams Court, Menlo Park, CA 94025*

Report No.: *3099390MPK-001*

Product Covered: *V-SEP Filtration System, Models LP Series, P-50 Series and I Series*

Description: *The V-SEP (Vibratory Shear Enhanced Process) is a membrane filtration system as an enhanced liquid/solid separation process used in variety of industries including wastewater treatment, industrial and chemical processing, food waste, pulp and paper, oil and gas production and processing. The equipment is intended for use in an ordinary (non-classified location).*

Standard(s): *Electrical Standard For Industrial Machinery (NFPA 79, 2002 Edition)*
Standard for Safety for Industrial Control Panels (UL 508A, 1st Edition, 04/25/2001)

This document is the property of Intertek Testing Services and is not transferable. Only the Applicant may reproduce this document. The certification mark(s) may be applied only at the above noted location of the Party Authorized To Apply Mark.

INTERTEK ETL LISTED US

Authorized by: for Michelle Lake **Date:** 24/04/06

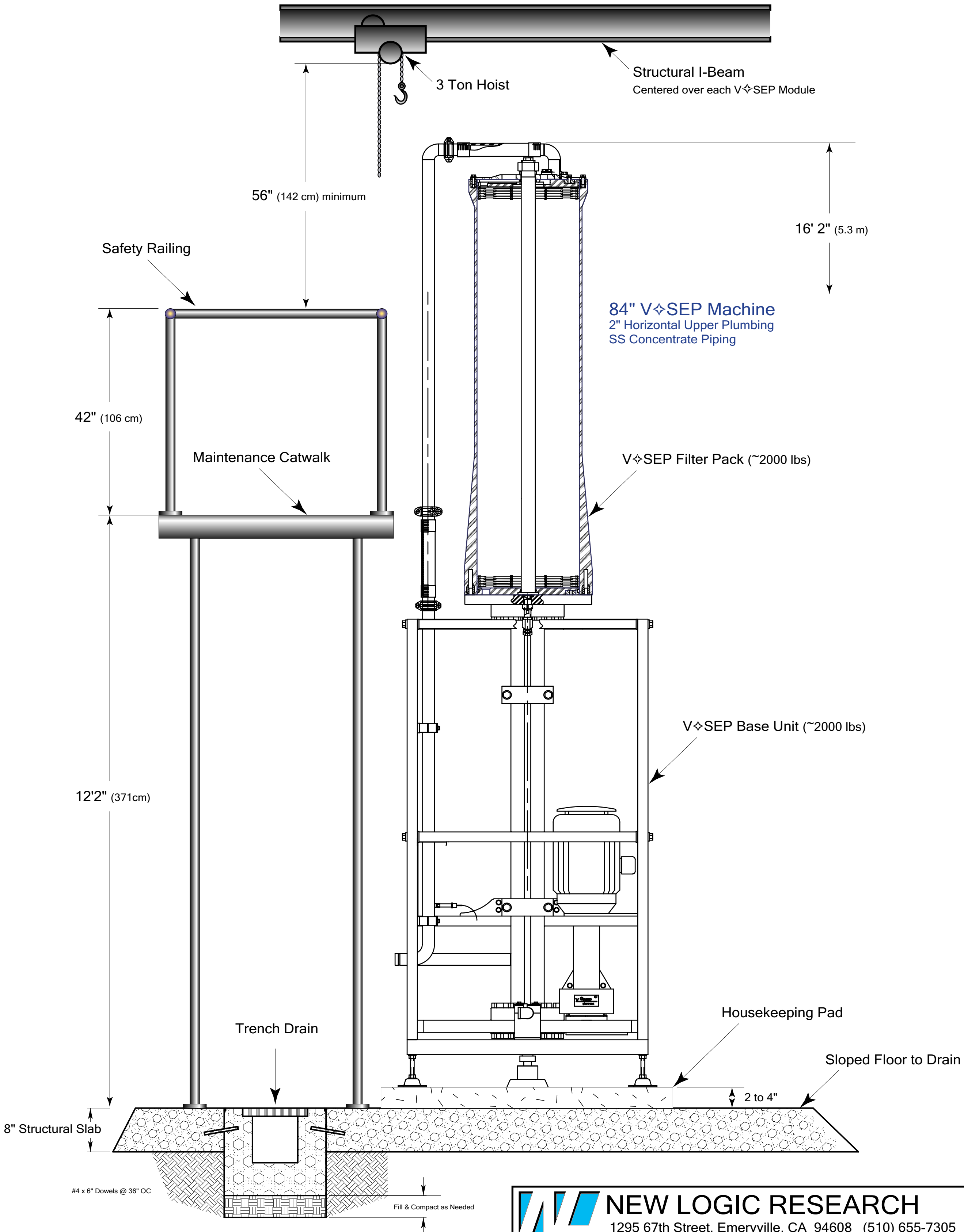
William T. Starr, Certification Manager

Control Number: 3082755

This document supersedes all previous Authorizations to Mark for the noted Report number.

Intertek Testing Services NA Inc.
165 Main Street, Cortland, NY 13045
Telephone 800-345-3851 or 607-753-6711 Fax 607-756-6699

V✧SEP Structural Building Components



Confidential Material

NEW LOGIC RESEARCH
1295 67th Street, Emeryville, CA 94608 (510) 655-7305

	Figure 17	09/21/11

84" V✧SEP Cross Section and Building Structure Components

Conversion Data

Pressure

from \ to	psi	Kg/cm^2	kPa	BAR
psi	1	.07031	6.895	.0689
Kg/cm^2	14.22	1	98.05	.981
kPa	.1451	.0102	1	.01
BAR	14.51	1.02	100	1

1 psi x 6.895 = 6.895 kPa

Area

from \ to	cm^2	m^2	in^2	ft^2
cm^2	1	.0001	.1550	.00108
m^2	10,000	1	1550.0	10.76
in^2	6.452	.000645	1	.00694
ft^2	929.0	.0929	144.0	1

1.0 m^2 x 10.76 = 10.76 ft^2

Volume

from \ to	liter	m^3	ft^3	gallon
liter	1	.001	.03532	.2642
m^3	1000	1	35.31	264.2
ft^3	28.32	.02832	1	7.481
gallon	3.785	.00379	.1337	1

1 gallon x 3.785 = 3.785 liter

Flow Rate

from \ to	ml/min	Liter/min	GPM	m^3/hr
ml/min	1	.001	3785.0	.00006
Liter/min	1,000	1	3.785	.06
GPM	.000264	.2642	1	.2271
m^3/hr	16,667	16.67	4.403	1

1.0 m^3/hr x 4.403 = 4.403 GPM

Flux (Flow per area per time)

from \ to	GFD	LMH
GFD	1	1.7
LMH	.5882	1

1.0 GFD x 1.7 = 1.7 LMH

Flow Converted to Flux

from \ to	Series L GFD	Series L LMH	Series LP GFD	Series LP LMH	1450 sf Series i GFD	1450 sf Series i LMH
ml/min	.76	1.292	.023	.0391	3785.0	6434.5
Liter/min	760	1292	23	39.1	3.785	6.435
GPM	2876.6	4890.22	87.06	148	1	1.7
m^3/hr	12665	21531	383.3	651.6	4.403	7.485

1 Liter/min x 23 = 23 GFD on a Series LP Machine

128 fl oz = 1 Gallon
8 Pints = 1 Gallon
4 Quarts = 1 Gallon
1 fl oz = 28.3 grams
1 Kilogram = 2.2 Pounds
1 Pound = 16 oz
1 Gallon = 8 Pounds
1 Horsepower = 0.7457 Kilowatts
1 Inch = 25.4 mm
1 Inch = 2.54 cm

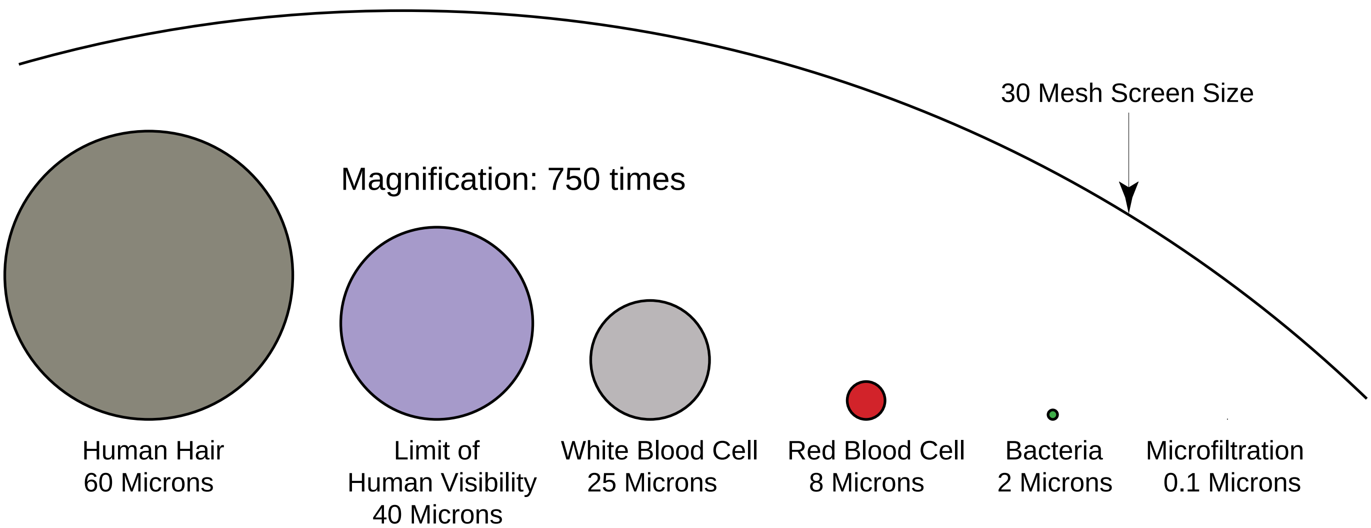
$$1\ \text{KW} = \frac{\text{Gal x ºF Temp Rise}}{\text{325 x Heat up time, hrs}}$$

Temperature

ºC	ºF	ºC	ºF	ºC	ºF
-200	-328	5	41	43	109
-180	-292	10	50	44	111
-160	-256	15	59	45	113
-140	-220	20	68	46	115
-120	-184	21	70	47	117
-100	-148	22	72	48	118
-95	-139	23	73	49	120
-90	-130	24	75	50	122
-85	-121	25	77	51	124
-80	-112	26	79	52	126
-75	-103	27	81	53	127
-70	-94	28	82	54	129
-65	-85	29	84	55	131
-60	-76	30	86	56	133
-55	-67	31	88	57	135
-50	-58	32	90	58	136
-45	-49	33	91	59	138
-40	-40	34	93	60	140
-35	-31	35	95	65	149
-30	-22	36	97	70	158
-25	-13	37	99	75	167
-20	-4	38	100	80	176
-15	5	39	102	90	194
-10	14	40	104	100	212
-5	23	41	106	120	248
0	32	42	108	140	284

Relative Particle Sizes:

1 Millimeter equals 1,000 Microns



Inches	Microns	Mesh Size	Inches	Microns	Mesh Size
.0787	2000	10	.0035	88	170
.0661	1680	12	.0029	74	200
.0555	1410	14	.0026	65	
.0469	1190	16	.0024	62	230
.0394	1000	18	.0021	53	270
.0331	840	20	.0020	50	
.0280	710	25	.0017	44	325
.0232	590	30	.0016	40	
.0197	500	35	.00142	36	400
.0165	420	40	.00118	30	
.0138	350	45	.00099	25	550
.0117	297	50	.00079	20	625
.0098	250	60	.00059	15	
.0083	210	70	.000394	10	1250
.0070	177	80	.000315	8	1750
.0059	149	100	.000197	5	2500
.0049	125	120	.000099	2.5	5000
.0041	105	140	.0000394	1.0	12000

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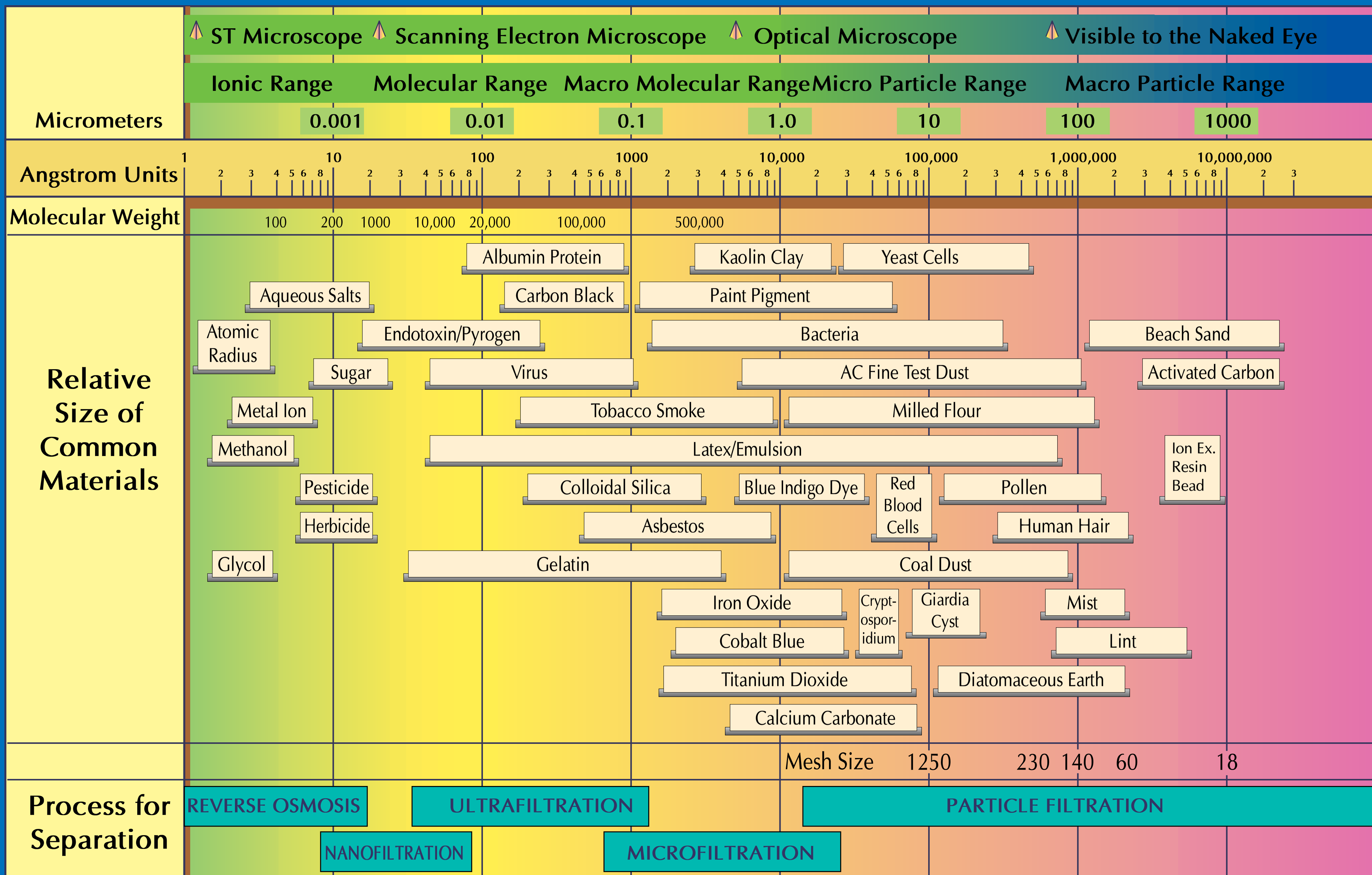
New Logic Research, Inc. The Filtration Spectrum



1 Micron (1×10^{-6} Meters) = ~ 4×10^{-5} Inches (0.00004 Inches)
1 Angstrom Unit = 10^{-10} Meters = 10^{-4} Micrometers (Microns)

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510-655-7305 (tel); 510-655-7307 (fax)
info@VSEP.com (e-mail); www.vsep.com

Flow Capacity Nomogram

Based on Formula:

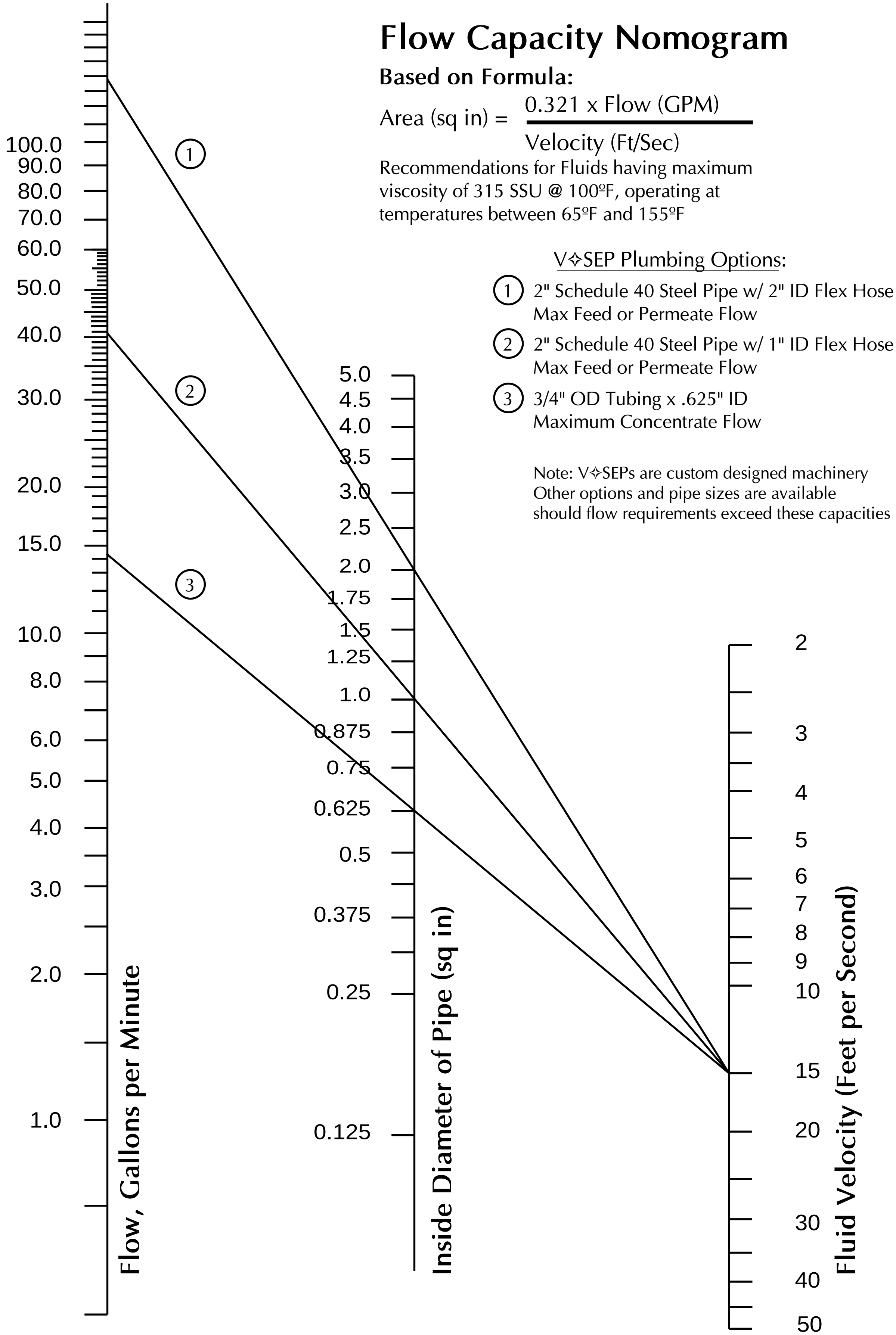
$$\text{Area (sq in)} = \frac{0.321 \times \text{Flow (GPM)}}{\text{Velocity (Ft/Sec)}}$$

Recommendations for Fluids having maximum viscosity of 315 SSU @ 100ºF, operating at temperatures between 65ºF and 155ºF

V✧SEP Plumbing Options:

1. 2" Schedule 40 Steel Pipe w/ 2" ID Flex Hose
Max Feed or Permeate Flow
2. 2" Schedule 40 Steel Pipe w/ 1" ID Flex Hose
Max Feed or Permeate Flow
3. 3/4" OD Tubing x .625" ID
Maximum Concentrate Flow

Note: V✧SEPs are custom designed machinery
Other options and pipe sizes are available
should flow requirements exceed these capacities



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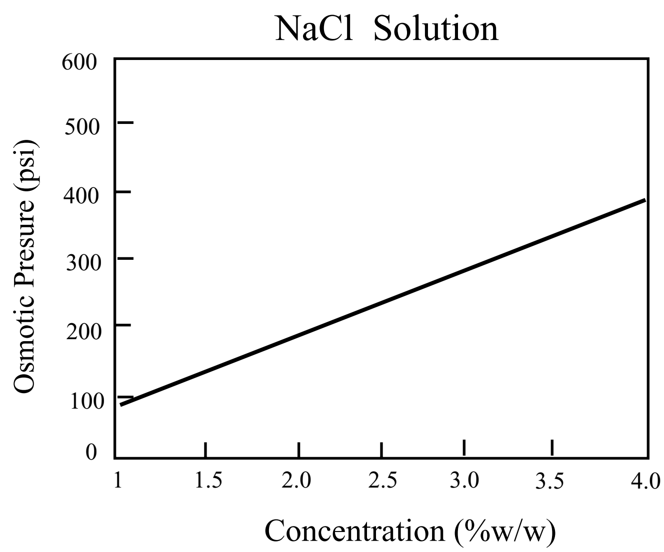
Pilot Test Handbook	Figure 26.3	Ver 3.0	4/05/03

Flow Capacity Nomogram

Osmotic Pressure

Effects of Osmotic Pressure:
Osmotic Pressure can be defined as the amount of pressure above 1 atmosphere which can restore equilibrium between a solvent in solution and the pure solvent at one atmosphere. Osmotic pressure is a colligative property based upon the molarity of a solution. The colligative molarity of a solution is the molarity in moles per liter multiplied by the number of ions produced by a molecule when dissolved in a solvent.

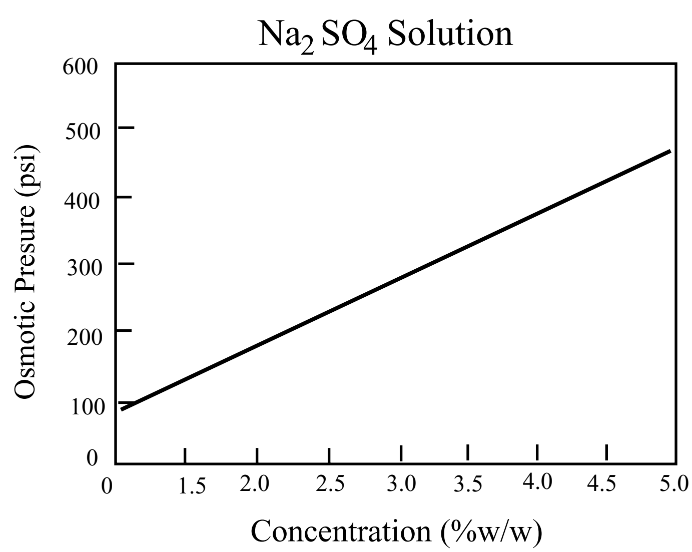
Osmotic pressure creates a resistance to flux through a membrane. Essentially the osmotic pressure can be subtracted from the feed pressure in order to determine the actual transmembrane pressure. When the osmotic pressure is approximately 100 psi less than the feed pressure then there will be little or no flux of water through the membrane. If the osmotic pressure is high enough then water may be driven back through the membrane.



Calculating the Osmotic Pressure of a Solution:
The osmotic pressure of a solution for dilute solutions is similar to the Ideal Gas Law. The osmotic pressure is proportional to the temperature and the colligative molality of the solution.

$$\Pi = R\ T\ M_c$$

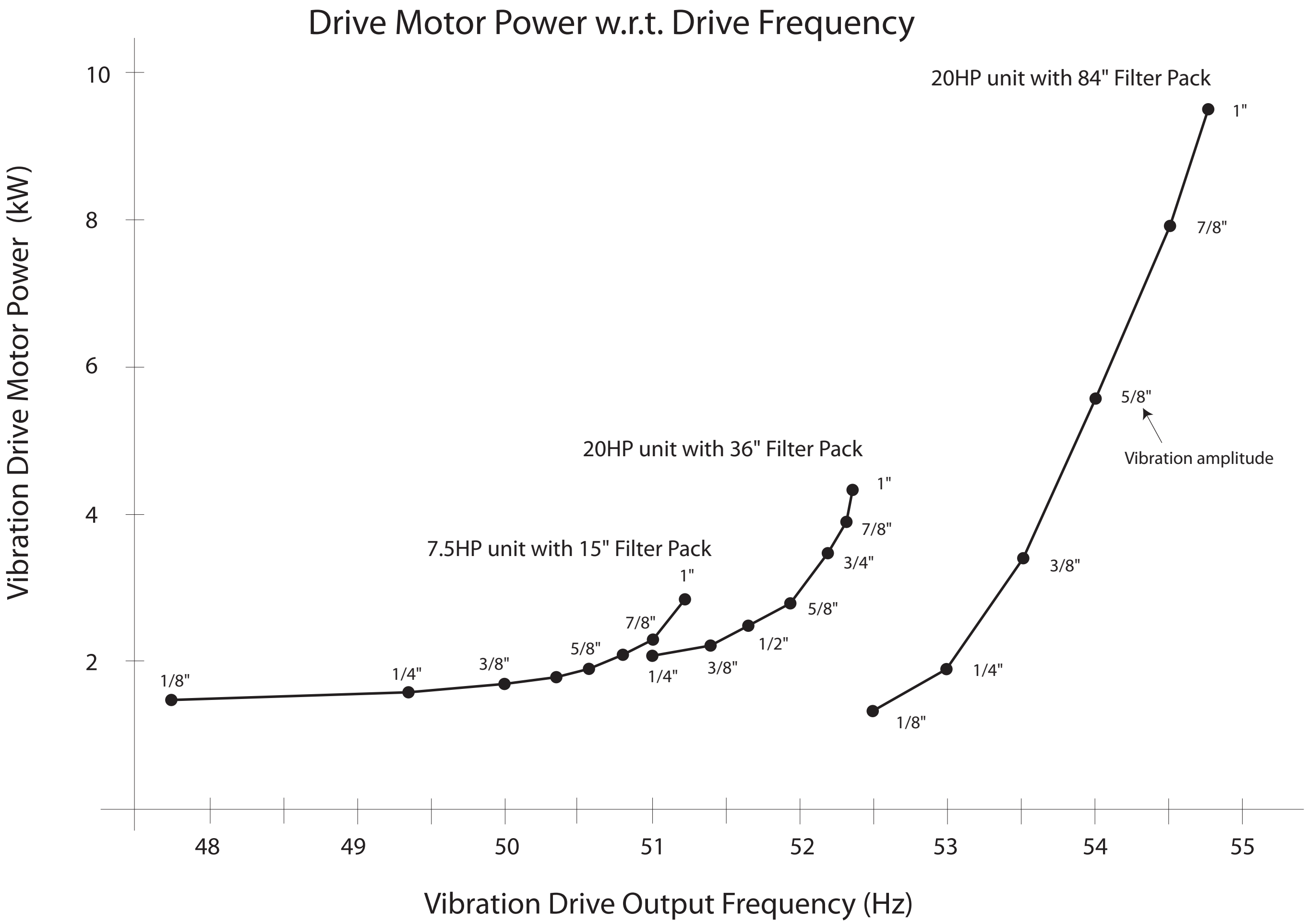
where
Π = Osmotic Pressure (atm.)
R = Gas Law Constant (lit. atm/mol. K)
T = Temperature (K)
M_c = Colligative Morality (Mol/lit.)



Graphs of Osmotic Pressure:
To the right are two graphs of osmotic pressure versus concentration for two different components dissolved in water. They can be used to give you an idea of the maximum concentration that can be achieved based on the osmotic pressure of the solution and the maximum feed pressure of a membrane separations system.

Given that the current system design of V✧SEP has a maximum feed pressure of 1000 psi, the maximum concentration of rejected material for Sodium Sulfate solution would then be a little more than 10%.

Use the equation given above to calculate the osmotic pressure for other solutions using the molecular weight and number of ions formed from each molecule.



Method: Incrementally increased frequency output of drive
Recorded %Motor Load and Vibration Amplitude
Power = (%Load / 100) x (MotorHP) x .746kW/1HP

7.5HP Unit with 15" Filter Pack

Equipment: V✧SEP Series i # I-180 Process Feed: Water at 76 psi

Data: (47.77Hz,26.7%,1/8"), (49.32Hz,28.1%,1/4")(49.99Hz,30.2%,3/8")
(50.36,32.2,1/2"),(50.6Hz, 34.4%, 5/8"),(50.81Hz,37.4%,3/4")
(51.02Hz, 41.4%, 7/8"), (51.2Hz, 50%, 1")

20HP Unit with 3' Filter Pack

Equipment: V✧SEP Series i # I-188 Process Feed: Water at 64 PSI

Process Feed: Water at 55 psi

Data: (49.3Hz,13.3%,1/8"), (51.02Hz,14%,1/4")(51.4Hz,14.5%,3/8")
(51.67,16.5%,1/2"),(51.93Hz, 18.8%, 5/8"),(52.07Hz,23.2%,3/4")
(52.3Hz, 26%, 7/8"), (52.34Hz, 29%, 1")

20HP Unit with 7' Filter Pack

Equipment: V✧SEP Series i # I-186 Process Feed: Water at 55 PSI

Process Feed: Water at 55 psi

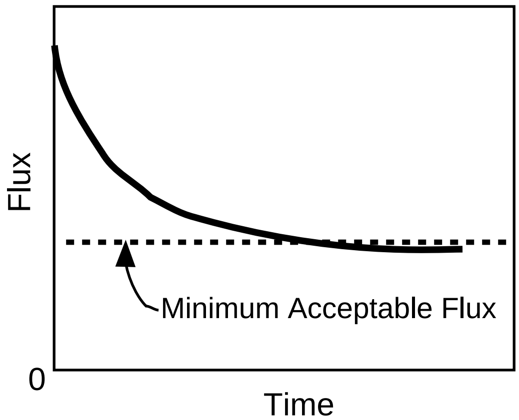
Data: (52Hz, 10%, 0"), (52.5Hz, 10.5%,1/8"), (53Hz, 13%, 1/4")
(53.5Hz, 18%, 3/8"), (54.0Hz, 32%, 5/8"), (54.5Hz, 53%, 7/8")
(54.7Hz, 65%, 1")

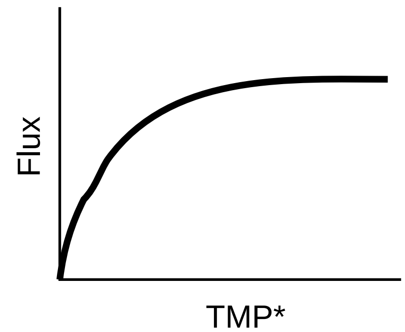
V✧SEP Basic Operation

Constant Feed Pressure

The two graphs at the right exhibit the attributes of a system that is operated with a constant feed pressure.

The graph on the left shows the flux decay that occurs with time. For this operation there will be a minimum acceptable operating flux that is based on the process flow rate. When the flux reaches the minimum level then the system is cleaned and the flux is recovered.

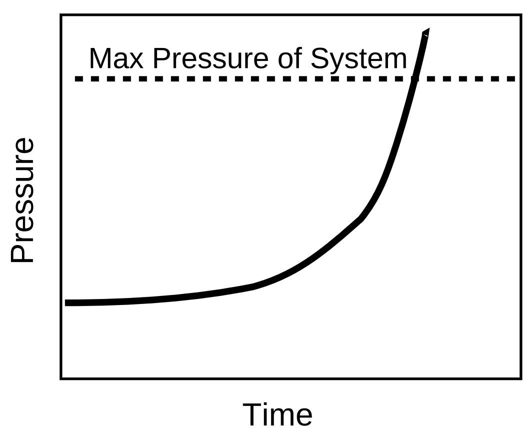


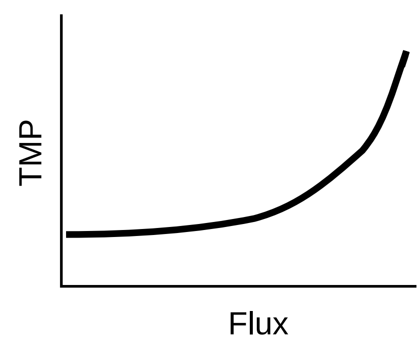


In the graph at the right, you can see the flux as it relates to the transmembrane pressure (TMP). As you can see from the graph, the flux increases as a result of increasing transmembrane pressure until a steady state is reached. This way of operating the system is the most simple and requires some measure of the flow rates in order to calculate the flux.

Constant Permeate Flow

The two graphs at the right show some of the operation characteristics for a system where the permeate flow rate is kept constant. The graph on the left shows the pressure as it relates to time. The pressure will increase with time in order to maintain the same flow rate. This is due to the fact that the flux will slowly decay as above. Instead of a minimum flux rate to indicate when the system needs to be cleaned the indicator is the maximum pressure that the system can withstand.



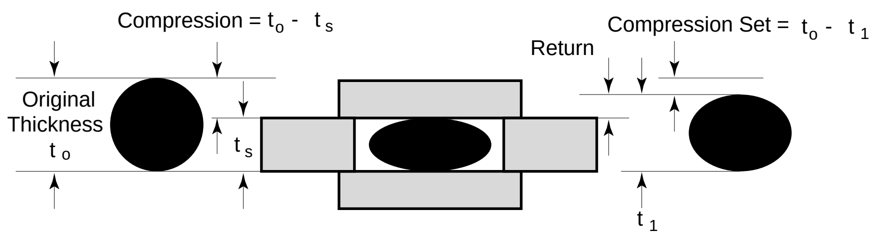


In the graph at the right, you can see the relationship between the transmembrane pressure (TMP) and the flux. In order to maintain a steady permeate flow to counter the flux decay, you will slowly increase the feed pressure with a motor speed controller. This system is a little more complex to control but produces the most consistent results especially where process flow rates are an important factor. The risk is that the pressure can be infinite and the system has a maximum pressure before the membranes and the machine are damaged.

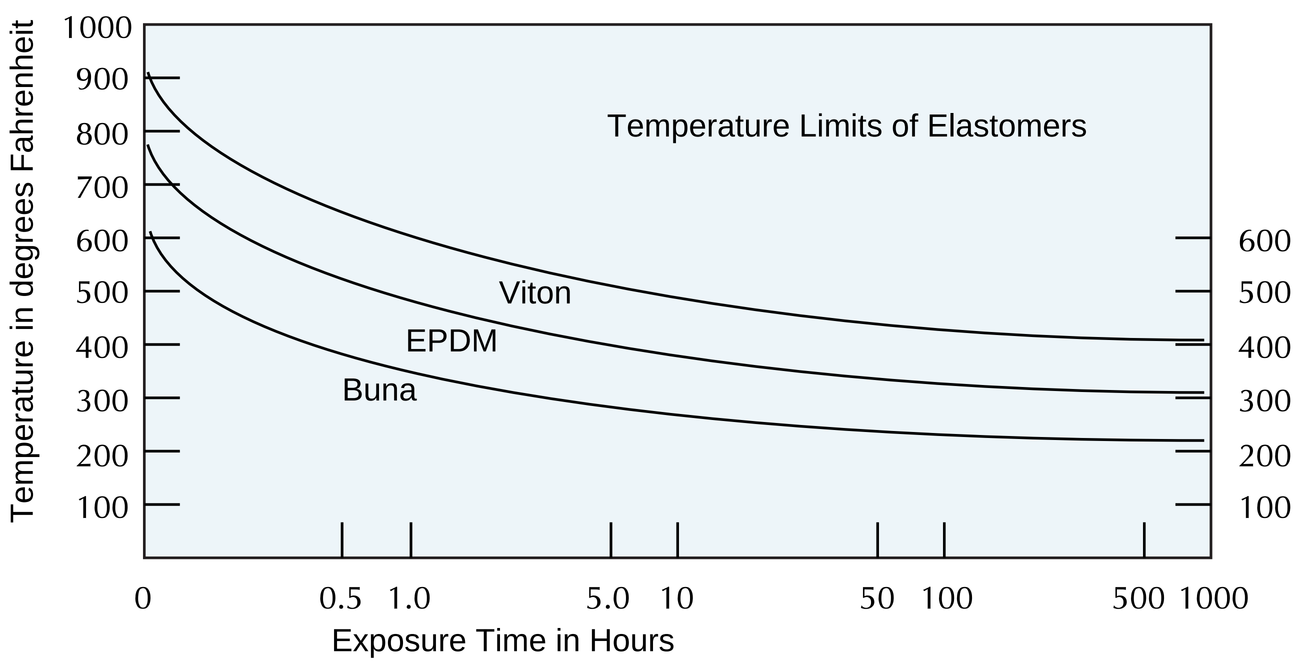
O-ring Seal Properties:

Various Elastomers Used:

EPDM: Ethylene propylene copolymer -65 ºF to +300ºF
Viton: Fluorocarbon Rubber -15 ºF to +400ºF
Buna: Copolymer of Butadiene and Acrylonitrite -65 ºF to +275ºF



Although it is desirable to have a low compression set, this is not as critical as it might appear. A good balance of all properties is usually necessary for optimum seal performance. For instance, a seal will continue to seal after taking a 100% compression set provided temperature and pressure remain steady. ASTM requires compression equal to 25% of t_o. In general V ✧SEP O-ring design includes face seal type glands and have a range of compressions between 20% and 30%.



Temperature limitations of elastomers are based on long term durability. As illustrated above short term or intermittent service at higher temperatures can be handled by these materials. Therefore, when the application requires higher temperature than that recommended, check the temperature curve to determine if the total accumulated time at high temperature is within the maximum allowable limit.

Temperature Limitations:

and thermal characteristics for
Series i Raw Materials used in construction

Location or Parts Used	Raw Material	Max Temp
Filter Pack End Plates	Polypropylene	180 ºF
Filter Pack End Plates	Teflon (PTFE)	500 ºF
Filter Pack End Plates	Kynar (PVDF)	285 ºF
Spring clamps, Bushings	Nylon (Cast 6)	230 ºF
Filter Pack Housing	Vinyl Ester FRP	200 ºF
O-rings & Seals	EPDM	300 ºF
O-rings & Seals	Viton (76)	410 ºF
O-rings & Seals	Buna (Nitrile)	275 ºF
Spring Node Rubbers	Polyurethane	190 ºF
Node Stabilizer Bumpers	Neoprene	170 ºF
Frame Plumbing Clamps	Polypropylene (copolymer)	212 ºF
Torsion Spring Clamps	Santoprene	302 ºF
Torsion Spring Clamps	Polyamide	350 ºF
Torsion Spring Clamps	Aluminum	750 ºF
Flexible Hose	1" Teflon	300 ºF
Flexible Hose	2" Teflon	300 ºF
Flexible Hose	2" Neoprene	212 ºF

Notes:

1] Other limitations exist as well, ie pressure, absorption, conductivity, creep, tensile strength, chemical resistance, etc.
2] Thermoplastics also have a melting point and will return to a liquid state.
3] Limits shown are for maximum continuous temperature of the media in contact
4] Mechanical properties such as pressure limits, tensile strength, coefficient of friction, etc are generally determined at room temperature (73ºF). As temperature increases the thermoplastic becomes more ductile, increases in impact strength, and decreases in tensile strength. Derating of materials may be necessary at higher temperatures
5] Thermoplastics melt before they burn when exposed to open flame, and generate toxic carbon monoxide, non-toxic carbon dioxide, water vapor, and dense smoke.
6] Plastic and rubber , unlike metal, is a very poor conductor of heat. Temperature related failure is likely to result at the point of contact with the media attached to it.

NEW LOGIC RESEARCH, INC.
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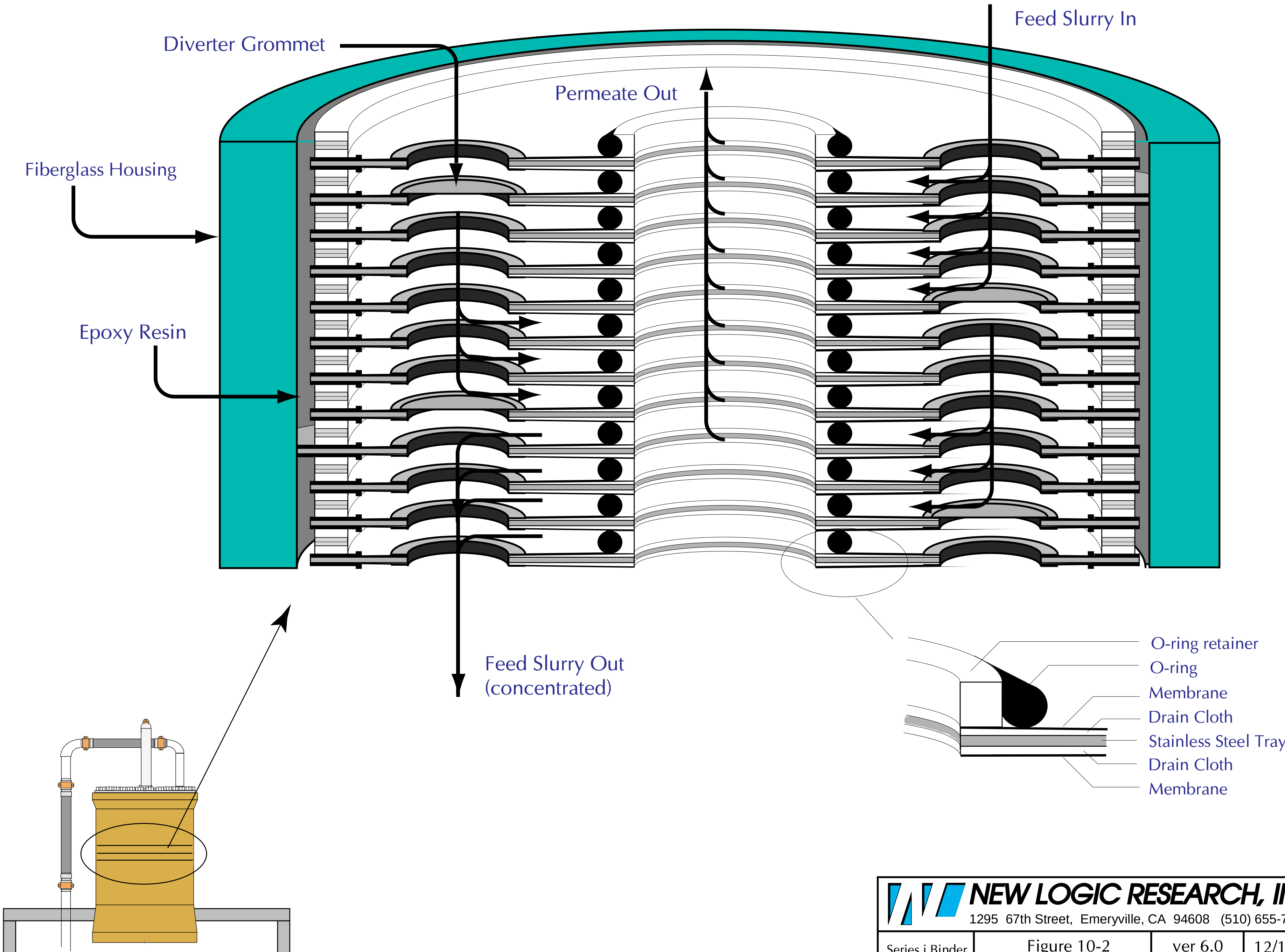
Pilot Test Handbook	Figure 26.7	Ver 3.0	4/05/03
Series i Raw Materials & Temperature Limits			



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Series i Binder	Figure 10-2	ver 6.0	12/15/02

Filter Pack Section Illustration

Viscosity Conversions:

for calculating pressure loss and flow limitations
of Series i Machines and pumps

Typical Liquids @ 70º F	SSU*	Centipoise
Water	31	0.8
Kerosene	35	2.05
No. 2 Fuel Oil	50	5.92
No. 4 Fuel Oil	80	12.6
Transformer Oil	100	16.2
Hydraulic Oil	200	34.6
SAE 10w Oil	300	52.2
SAE 10 Oil	500	88.0
SAE 20 Oil	1,000	173
SAE 30 Oil	2,000	352
SAE 50 Oil	5,000	880
SAE 60-70 Oil	10,000	1,760
Molasses B	50,000	8,800
Molasses C	100,000	17,300

Viscosity: The viscosity of a fluid is a measure of its tendency to resist shearing force. High viscosity fluids require a greater force to shear at a given rate than low viscosity

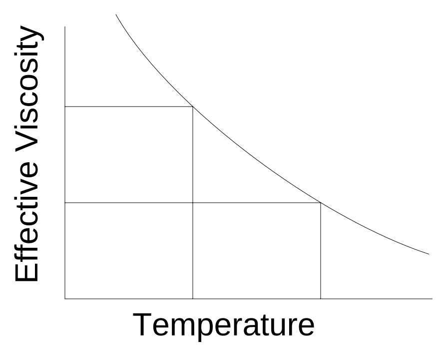
Centipoise: (cps) Measures absolute viscosity = 1/100th of a Poise

SSU: Staybolt Second Universal; measures the kinematic viscosity where the specific gravity of the fluid influences the viscosity measured

Conversion: SSU x .216 x Specific Gravity = Centipoise

Pumping Viscous Liquids:
Centrifugal pumps are generally not suitable for pumping viscous liquids. However, liquids with viscosities up to 2000 SSU can be handled with centrifugal pumps. The volume and pressure of the pump will be reduced according to the following table. Comparisons are made against water: 30 SSU

Viscosity SSU	30	100	250	500	750	1000	1500	2000
Flow Reduction % GPM	--	3	8	14	19	23	30	40
Head Reduction % Feet	--	2	5	11	14	18	23	30
Horsepower % Increase	--	10	20	30	50	65	85	100



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Pilot Test Handbook	Figure 27.1	ver 3.0	12/15/03

Viscosity Conversions for Series i Calculations

The Viscosity of Water: 0 C to 100 C

C	cp	C	cp	C	cp	C	cp
0	1.787	26	.8705	52	.5290	78	.3638
1	1.728	27	.8513	53	.5204	79	.3592
2	1.671	28	.8327	54	.5121	80	.3547
3	1.618	29	.8148	55	.5040	81	.3503
4	1.567	30	.7975	56	.4961	82	.3460
5	1.519	31	.7808	57	.4884	83	.3418
6	1.472	32	.7647	58	.4809	84	.3377
7	1.428	33	.7491	59	.4736	85	.3337
8	1.386	34	.7340	60	.4665	86	.3297
9	1.346	35	.7194	61	.4596	87	.3259
10	1.307	36	.7052	62	.4528	88	.3221
11	1.271	37	.6915	63	.4462	89	.3184
12	1.235	38	.6783	64	.4398	90	.3147
13	1.202	39	.6654	65	.4335	91	.3111
14	1.169	40	.6529	66	.4273	92	.3076
15	1.139	41	.6408	67	.4213	93	.3042
16	1.109	42	.6291	68	.4155	94	.3008
17	1.081	43	6178	69	.4098	95	.2975
18	1.053	44	.6067	70	.4042	96	.2942
19	1.027	45	.5960	71	.3987	97	.2911
20	1.002	46	.5856	72	.3934	98	.2879
21	0.9779	47	.5755	73	.3882	99	.2848
22	0.9548	48	.5656	74	.3831	100	.2818
23	0.9325	49	.5561	75	.3781		
24	0.9111	50	.5468	76	.3732		
25	0.8904	51	.5378	77	.3684		

Use the Correction Factors above to Temperature Correct Flux:

$$\text{Actual GFD Measured} \quad \times \frac{\text{Viscosity of water @ actual temperature}}{\text{Viscosity of water @ correction temperature}} = \text{Temperature Corrected GFD}$$

Example: 43 gfd was measured @ 18 C, Temperature Correct to 40 C

$$43 \text{ gfd} \quad \times \frac{1.053}{.6529} \quad = \quad 43 \text{ gfd} \quad \times \quad 1.6128 = \quad 69.4 \text{ TC GFD}$$

27.3 Conversion Factors & Formulas

Legend:

GFD	= Gallons per square foot per day	fps	= Feet per second
LMH	= Liters per square meter per hour	RPM	= Rotations per minute
°C	= Degrees Centigrre	SSU	= Staybolt Second Univerade
SSU	= Staybolt Second Universal	°F	= Degrees Fahrenheit
ID	= Inside Diameter	GPM	= Gallons per minute
FPM	= Feet per Minute	SF	= Square feet of membrane
# Trays	= Number of membrane trays in FRP		

For converting GFD (Gallons per square foot per day) to LMH (Litres per square meter)

GFD x 1.72 = LMH

For converting Gallons per minute (GPM) to LPH (Litres per hour)

GPM x 227.1 = LPH

For converting Gallons per minute (GPM) for a certain size Filter Pack to GFD(Gallons per square foot per day)

GPM x 1440 ÷ SF of filter pack = GFD

For determining the square footage of a Filter Pack (3.058sf = membrane area of one tray)

#Trays x 3.058 = SF

For converting degrees Celsius to Fahrenheit & visa versa

°C = 5/9 (°F - 32)   °F = 9/5 C + 32

For converting SSU to Centipoise (Measures of Viscosity)

SSU x .216 x Specific Gravity = Centipoise

For determining pipe size required for specific flow rates (GPM) and fluid velocity (FPS)

Pipe ID Required (sq in) = 0.321 x Flow(gpm) /Velocity (fps)

For determining the speed of travel of the outer casing of the eccentric bearing

Surface Speed (fpm) = Shaft Diameter x RPM x 0.26227.

For determining solids concentrations

%Solids = (Grams Solute/Grams Solution) x100

Foot Pounds x 12 = Inch Pounds
Inch Pounds x 0.082 = Foot Pounds
Inches x 2.54 = Centimeters
1 Gal water = 2786 grams @ 50°F
1 Gal water = 3.785 Liters
1 Liter = .2642 Gallons

p = 3.14159
Series L Membrane = 0.478 SF
Series LP Tray = .865/ea
Series i Tray = 3.058/ea
Specific Gravity of Water = 62.4 lbs

V✧SEP Performance Calculations

Concentration Factor:

Concentration Factor = Feed Flow Rate / Concentrate Flow Rate
Feed Flow Rate = Permeate Flow Rate + Concentrate Flow Rate

Example: Your Permeate Flow Rate is 2179ml/min
Your Concentrate Flow Rate is 179 ml/min

Feed Flow Rate = 2179 ml/min + 179 ml/min
Feed Flow Rate = 2358 ml/min

Concentration Factor = 2358 ml/min / 179 ml/min
Concentration Factor = 13.2x

Concentrate Flow Rate: (while using the timed duty cycle valve)

Concentrate Flow Rate per Minute = Concentrate Rate per dump / (Time Open + Time Closed)

Example: 430 ml of concentrate is released each time the valve opens
Your Auto Valve settings are 0.5 minutes open and 3.0 minutes closed

Concentrate Flow Rate = 430 ml / (0.5 + 3.0)
Concentrate Flow Rate = 430 ml / 3.5
Concentrate Flow Rate = 123 ml/min

% Recovery: (Permeate)

% Recovery = Permeate Flow Rate / Feed Flow Rate x 100
Feed Flow Rate = Permeate Flow Rate + Concentrate Flow Rate

Example: Your Permeate Flow Rate is 2179ml/min
Your Concentrate Flow Rate is 179 ml/min

Feed Flow Rate = 2179 ml/min + 179 ml/min = 2358 ml/min
% Recovery = 2179 ml/min / 2358 ml/min x 100
% Recovery = 92.4%

GFD in P Mode: (Gallons per Square Foot of Membrane per Day)

Example:
2000 ml/min x .0002642 Gal/ml = .528 Gallons/min
.528 Gal/min x 1440 min/Day = 761 Gal per Day
761 GPD / 16.69 SF/Filter Pack = 45.596 GFD

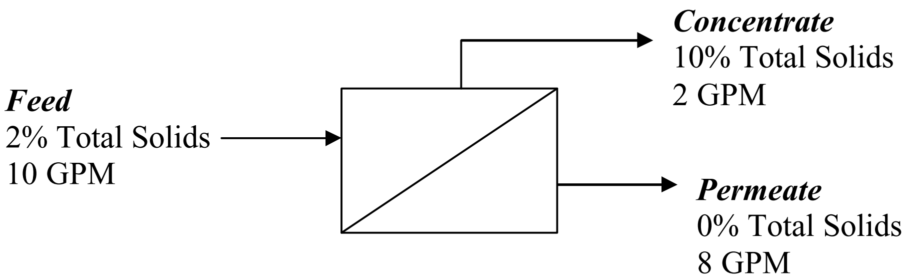
2000 ml/min x .0228 = GFD

Permeate Rate x .0228 = GFD

GFD in L Mode: (Gallons per Square Foot of Membrane per Day)

Permeate Rate x .76 = GFD

Concentration Factor related to % Recovery



When there are virtually no solids in the permeate then that calculations of concentration factor and recovery can be easily related. In the above example you calculate % recovery (permeate) by dividing the permeate flow rate or amount of permeate by the feed flow rate or amount of feed.

8/10 = 0.8 = 80% permeate recovery

The concentration factor can be calculated by dividing the final solids by the initial solids.

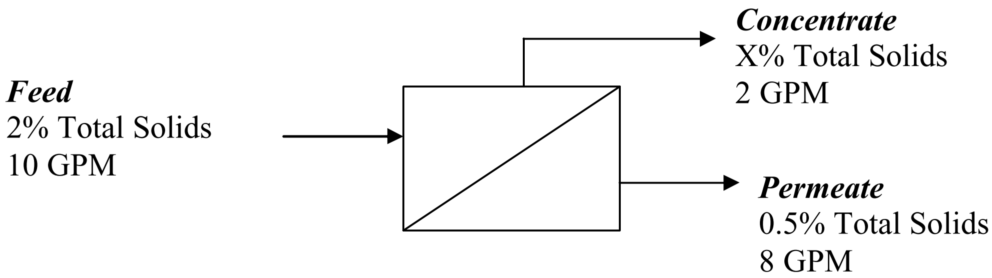
10/2 = 5x concentration of solids

These two are related by the following equation:

Concentration Factor (CF) = 1/(1-%Recovery) = 1/(1-0.8) = 5

You can do a similar calculation for 90% recovery and should do it for practice. What you will find by doing the calculations is summarized in the following table.

% Recovery	CF
50	2X
60	2.5X
70	3.33X
75	4X
80	5X
85	6.67X
90	10X
95	20X
98	50X



When there are solids in the permeate then that calculations of concentration factor and recovery might be a little more difficult. In the above example you are given the solids in the feed and the solids in the permeate but lets assume that a hose broke on the machine and so you had no concentrated material to test % solids. You can calculate this using a material balance. A material balance basically indicates that whatever goes in must come out.

The first thing you do is determine the total flow of solids by multiplying the % solids by the flow.

10 x 2 = 20 in the feed (no real units here)

Then you want to set that equal to what you know comes out so:

20 = (Total in Concentrate) + (Total in Permeate)
20 = (2X) + (8x0.5) = 2X + 4

Solving for X you get:

16 = 2X or X = 8

Therefore the amount of solids in the concentrate is 8%. The concentration factor would be 8/2 = 4x. But note that the recovery in this case is still 80% even though the concentration factor is lower.

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TECHNICAL INFORMATION

Corrosion Data

The information presented in this data chart is intended as a guide to the chemical resistance to materials used in the manufacture of SVF valves.

Many factors which will influence corrosion rating such as - temperature fluctuations, concentrations and aeration of fluids, high velocity or abrasions in the fluid steam, etc. have to be taken into account. The physical properties of material are affected differently by each corrosive media and is sometimes necessary to sacrifice valves in one property to gain a maximum valve in another property.

An "A" rating should be given to internal moving parts, in direct contact with the media. In some cases a "B" rating can be given to body material in direct contact with media, when the corrosion rate is not one to cause any serious problems.

Ratings Explanation

A = Excellent / B = Good / C = Poor / D = Do not use

Blank = No information available.

Ratings are based on media at room temperatures = unless otherwise specified.

We would advise that ratings given to be used as a guide to the selection or valve materials and not as an absolute recommendation.

Although most of the suggested ratings in this corrosion chart are based on experience, SVF cannot accept responsibility for problems arising from use of this data.

We do however recommend that in critical applications, tests be conducted to verify the rating.

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Acetaldehyde	B	C	C	C	A		A	A	A	D	A	B	C		A
Acetamide	B	B	B	B	B					A	A				A
Acetate Solvents	A	B	A	B	A			A	A	D	D		D		A
Acetic Acid, aerated	B	D	D	D	A			A	A	C	D		C	A	A
Acetic Acid, Air Free	B	B	D	D	A	A	A	A	A	C	D		D	A	A
Acetic Acid, crude	C	C	C	C	A	A	A	B	A	D	D		D	A	A
Acetic Acid, glacial						A			A	D		B	C	A	A
Acetic Acid, pure	C	C	D	D	A	A	A	D	A	D	D		D	A	A
Acetic Acid, 10%	C	C	C	C	A	A	A	B	A	D	B	B	D	A	A
Acetic Acid, 80%	C	C	C	C	A	A	A	B	A	D	D	C	D	A	A
Acetic Acid Vapors	B	D			D	D	B	C	A	D				A	A
Acetic Anhydride	B	D	D	D	B	B	B	B	A	D	C	C	D	A	A
Acetone	A	A	A	A	A	A	A	A	A	D	A	A	D	A	A
Other Ketones	A	A	A	A	A	A	A	A	A	D	A	D	D		A
Acetyl Chloride	D	A		D	C			B	A	D	D	D	D		A
Acetylene	A	B	A	A	A	A	A	A	A	B	A	A	A		A
Acid Fumes	B	D	D	D	B		B			C	D				A
Acrylonite	B	A	A	C	A		B	A	A	D	D	D	C		A
Air	A	A	A	A	A		A	A	A	A	A	A	A		A
Alcohol, Amyl	B	B	B	C	A		B	B	B	C	A	A	B	A	A
Alcohol, Butyl	B	B	B	C	A		A	A	A	B	A	C	A	A	A
Alcohol, Diacetone	A	A	A	A	A		A	B	A	D	A	B	D	A	A
Alcohol, Ethyl	B	B	B	B	B		A	B	A	A	A	A	A	A	A
Alcohol, Fatty	B	B	B	B	A		A		A	B	A	A		A	A
Alcohol, Isopropyl	B	B	B	B	B		A	B	B	C	A	A	A	A	A
Alcohol, Methyl	B	B	B	B	A		A	A	A	B	A	A	C	A	A
Alcohol, Propyl	A	A	B	B	A		A	A	A	B	A	A	A	A	A
Alumina	A	A							A	A	A	A			A
Aluminum Acetate	C	D		D	A	B	B	C	B	D	D	A	D		A
Aluminum Chloride dry	B	B	C	D	C		D	B	B	B	A	A	A	A	A
Aluminum Chloride Solution	C				D	C	B	B	A	B	D		A	A	A
Aluminum Fluoride	C		D	D	C			B	A	A	C	A	A		A
Aluminum Hydroxide	A	A	D	D	A	B	B	B	B	A	C	A	A		A
Aluminum Nitrate	D	D		D	C		B	C	B	B	D	B	D		A
Aluminum Oxalate	B						A	B	A						A
Alum (Aluminum Potassium Sulfate)	D	D		D	B	C	B	C	A	B	D		B	A	A
Alum (Aluminum Sulfate)	C	C	D	D	B	A	B	C	A	A	D	A	A	A	A
Amines	B	B	B	C	A	A	A	B	B	D	C	C	D		A
Ammonia, Alum	C				A		A		A	B	C			A	A
Ammonia, Anhydrous Liquid	A	D	A	B	A	A	A	B	A	B	D	B	D	A	A
Ammonia, Aqueous	B	D	A	A	A		A	B	B	B	D		A	A	A
Ammonia, Gas, hot	A	D		B	A		A	B	B	C	D	A	D	A	A
Ammonia Liquor					A		A		B					A	A
Ammonia Solutions	C	D	B	B	A		A	B	B	B	D	B	D	A	A
Ammonium Acetate	B	D		B	B		A	B	B	B	D	A	D		A
Ammonium Bicarbonate	B	B	C	B	B		B	B		B	A	A	A		A
Ammonium Bromide 5%	D				B		B	B			A				A
Ammonium Carbonate	B	B	B	B	B		B	B		C	D	A	B		A
Ammonium Chloride	D	D	D	D	C	C	B	B	B	B	C	A	A		A
Ammonium Hydroxide 28%	C	D	C	C	B	A	A	D	B	B	D	B	A	A	A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Ammonium Hydroxide Concentrated	C	D	C	C	B	A	A	C	B	C	D	A	A	A	A
Ammonium Monosulfate	D				A		B	B	B		D				A
Ammonium Nitrate	B	D	D	D	A	A	B	D	B	A	D	A	A		A
Ammonium Oxalate 5%	A				A		A	B			A				A
Ammonium Persulfate	C	C			A		A	D		D	D	B	B		A
Ammonium Phosphate	C	D	D	D	B		B	C		A	C	A	A		A
Ammonium Phosphate Di-basic	B	C	D	D	B		B	C	B	A	A		A		A
Ammonium Phosphate Tri-basic	C	C	D	D	B		B	C	B	A	A		A		A
Ammonium Sulfate	C	C	C	D	B	B	B	B	B	A	B	A	B	A	A
Ammonium Sulfide	C	D	D	D	B		B	B		A	A	A	D		A
Ammonium Sulfite	C	C	C	C	A		B	D		B	A	B	A		A
Amyl Acetate	B	B	C	C	B	A	A	B	A	D	A	B	D		A
Amyl Chloride	D	B		B	A		A	B	B	D	A	D	D		A
Aniline	C	D	C	C	B		A	B	B	D	D	C	C	A	A
Aniline Dyes	C	C	C	C	A		A	A		C	A	C	B		A
Apple Juice	B	C	D	D	B		A	A		A	A	B	A		A
Aqua Regia (Strong Acid)	D	D	D	D	B		B			D	D	D	D	D	A
Aromatic Solvents	A	A	C	B	A		A	B		D	A	D			A
Arsenic Acid	D	D	D	D	B		B	D	B	A	D	B	A	A	A
Asphalt Emulsion	C	A	B	B	A		A	A	A	D	A	D	A		A
Asphalt Liquid	C	A	B	B	A		A	A	A	C	A	D	A		A
Barium Carbonate	C	B	B	B	B		B	B	A	B	A	A	A		A
Barium Chloride	D	B	C	C	B	B	C	B		A	A	A	A		A
Barium Cyanide	D	C		C	B		B	D		B	A	B	B		A
Barium Hydrate	D	D			A		A	B			A				A
Barium Hydroxide	D	C	C	B	B	A	A	B		A	A	B	A		A
Barium Nitrate	B				A		A				A				A
Barium Sulfate	D	C	C	C	A		A	B		A	A	B	A		A
Barium Sulfide	D	D	C	D	B		B	C		A	A	A	A		A
Beer	A	B	D	D	A	A	A	A		B	A	B	A		A
Beet Sugar Liquors	A	A	B	B	A		A	A		A	A	B	A		A
Benzaldehyde	A	A	A	C	A		A	B	B	D	A	A	D		A
Benzene (Benzol)	B	B	B	B	B	B	A	A	B	D	C	D	B	A	A
Benzoic Acid	B	B	D	D	B	A	B	B	A	C	A	D	B		A
Beryllium Sulfate	B	B		B	B		A	B		B	A	B	B		A
Bleaching Powder wet		B			C		B	D	A	D	D	B	B		A
Blood (Meat Juices)	B	B		D	A	A	A	B		B	A	B	B		A
Borax (Sodium Borate)	C	D	C	C	A			A	A	B	A	A	A		A
Bordeaux Mixture					A		A				A				A
Borax Liquors	C	A	C	C	B		A	A	B		A	A	A		A
Borax Acid	B	C	D	D	B		B	B	A	B	A	B	A	A	A
Brake Fluid	B	B		B	B	A		B		D	B	B	D		A
Brines, saturated	C	B	D	C	B		B	B	A	A	A	A	A		A
Bromine, dry	C	B	D	D	D		B	A	A	D	D	D	B	B	A
Bunker Oils (Fuel)	A	B	B	B	A		A	A		B	A		A		A
Butadiene	B	C	B	B	A		A	C	B	C	A	C	B		D
Butane	A	A	B	B	A		A	B	A	B	A	D	A		A
Butter					A		A			B	A				A
Buttermilk	A	D	D	D	A		A	D		A	A	B	A		A
Butyl Acetate	B	B		B	B		A	B	B	D	B	D	D		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Butylene	A	A	A	A	A		A	A		D	A	D	D		A
Butyric Acid	B	C	D	D	B		B	B	A	C	A	C	C		A
Calcium Bisulfate	C	C	D	D	B		B	D	B	A	D	D	A		A
Calcium Carbonate	C	C	D	D	B		B	B	B	A	A	B	A		A
Calcium Chlorate	B	D		C	B		B	B		B	D	B	B	B	A
Calcium Chloride	C	B	C	C	B	B	B	B	A	A	A	B	A		A
Calcium Hydroxide	D	C	C	C	B		B	A	A	A	A	A	A		A
Calcium Nitrate	B				B		B			B	C	B			A
Calcium Phosphate	D	C		C	B		B			B	B	B	B		A
Calcium Silicate	D	C		C	B		B			B	A	B	B		A
Calcium Sulfate	B	C	C	C	B	B	B	B	B	A	A	B	A		A
Caliche Liquor			B		A		A			B	A	A			A
Camphor	C	C		C	B		C	C		B	A	A	B		A
Cane Sugar Liquors	A	B		B	A		A	B		B	A	D	B		A
Carbonated Beverages	B	B	D	B	B	B	B	C		B	A	B	B	A	A
Carbonated Water	A	B	B	A	A	B	A	B		A	A	A	A	A	A
Carbon Bisulfide	A	C	B	B	B		B	B		D	A	D	A		A
Carbon Dioxide, Dry	A	A	A	B	A	A	A	A		C	A	B	B	A	A
Carbonic Acid	A	D	D	D	B	B	A	B		B	A	B	A	A	A
Carbon Monoxide	A	A		B	A	A	A	A	A	B	A	B	B		A
Carbon Tetrachloride, dry	B	C	B	C	A	A	A	A	A	D	A	D	B	A	A
Carbon Tetrachloride, wet		D	D	D	B		B	B	B	D	B	D	B	A	A
Casein	C	C		C	B		B	C		B	A	B	B		A
Caster Oil	A	A	B	B	A		A	A	A	A	A	B	A		A
Caustic Potash					A		A	B		B	D				A
Caustic Soda	D		B	B	A		A	A		C	D	B	B		A
Cellulose Acetate	B	B		B	B			B	B	D	C	B	D		A
China Wood Oil (Tung)	A	C	C	C	A		A	A	A	A	A	D	A		A
Chlorinated Solvents	D	C	C	C	A		A	B		D	A	D	C		A
Chlorinated Water	C				C	D	A	D	D	B	D		A	B	A
Chlorine Gas, dry	B	C	B	B	B	C	A	A	A	C	D	D	B	A	A
Chlorobenzene, dry	B	B	B	B	A		A	B	B	D	B	D	A		A
Chloroform, dry	D	B	B	C	A	B	A	A	B	D	A	D	B		A
Chlorophyll, dry	B	B		B	B		A	B		B		B	B		A
Chlorosulfonic Acid, dry	B	C	B	B	B		B	B	A	D	D	D	D		A
Chrome Alum	C	C	B	C	A		A	B		B	B	B	B		A
Chromic Acid < 50%	C	D	D	D	C	C	B	C	B	D	D	C	C		A
Chromic Acid > 50%	D	D	D	C	C	D	B	D	B	D	D	C	C		A
Chromium Sulfate	B	C		D	B		C	B		B	C	B	B		A
Cider	B				A		B	A			A				A
Citric Acid	B	C	D	D	B	C	A	B	A	B	A	B	A	A	A
Citric Juices	C	B	D	D	B		A	A		A	A		A		A
Coca-Cola Syrup					A		A			B	A		B		A
Coconut Oil	B	B	C	C	B		A	B		A	A	A	A		A
Coffee	A	A		D	A		A	B		A	A	A	A		A
Coffee Extracts, hot	A	B	C	C	A		A	A			A				A
Coke Oven Gas	A	C	B	B	A		A	B		C	D	D	B	A	
Cooking Oil	B	B	B	B	A		A	A		A	A	D	A		A
Copper Acetate	D	D	D	D	A		A	C	B	C	D	B	D		A
Copper Carbonate	D				A		A				A				A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Copper Cyanide	D	D		D	A		A	C		A	A	B	B		A
Copper Nitrate	D	D	D	D	B		B	D		A	A	B	A		A
Copper Sulfate	D	D	D	D	B	B	B	C	A	A	A	A	A	A	A
Corn Oil	B	B	C	C	B		B	B		A	A	C	A		A
Cottonseed Oil	B	B	C	C	B		B	B		A	A	C	B		A
Cresol					B		B			D	D	D	D		A
Creosote Oil	B	B	B	B	B	B	A	B	B	C	D	D	A		A
Cresylic Acid	C	C	C	D	B		B	B		D	D	D	B		A
Crude Oil, sour	B	C	B	C	A		A	B		A	A	D	A		A
Crude Oil, sweet	A	B	B	B	A		A	A		A	A		A		A
Cupric Nitrate	D				A		A	D			D				A
Cutting Oils, Water Emulsions	A	A	B	B	A		A			A	A		A		A
Cyanide Plating Solution	D	D		D	B		B	D		B	D	B	B		A
Cyclohexane	A	A	A	A	A		A	B	B	C	A	D	A		A
Cyclohexanone	B	B			A		A	B	B	D	A				A
Detergents, synthetic	B	B		B	B		A	B		B	A	B	A		A
Dextrin	B	B		B	B		B	B		B	A	B	B		A
Dichloroethane				C	C		B	B		D	D	D			A
Dichloroethyl Ether	B	B		B	B		B			D	D	D	D		A
Diesel Oil Fuels	A	A	A	A	A		A	A		A	A	D	A		A
Diethylamine	B	B	A	B	A		A	B		B	A	C	D		A
Diethyl Benzene					B		B			D	C	D			A
Diethylene Glycol	B	B		A	A		A	B		A	A	A	B		A
Diethyl Sulfate	B	B		B	B		B	B		C	A	C	B		A
Dimethyl Formamide	B	B		B	A		A	B		B	A	D	D		A
Dimethyl Phthalate										B	C		D		A
Dioxane	B	B		B	B		B	B		D	C	C	D	A	A
Dipentane (Pinene)	A	A		A	A		A			B	A	D	B		A
Disodium Phosphate	B				B		B	C		B	A		B		A
Dowtherm	A	A	B	B	A		A	A		D	A	D	A	A	A
Drilling Mud	B	B	B	B	A		A	B		A	A	A	A		A
Dry Cleaning Fluids	A	C	B	B	A		A	B		D	A		B		A
Drying Oil	C	C	C	B	B		B	B		A	A				A
Enamel		A								B	A	D			A
Epsom Salts ($MgSo_4$)	A	B	C	C	B		B	B		A	A		A		A
Ethane	A	B	C	C	B		B	B		A	A	D	A		A
Ethers	A	B	A	B	A	B	A	B		D	C	C	C		A
Ethyl Acetate	A	C	B	C	B	A	B	B	B	D	C	C	D		A
Ethyl Acrylate	C	B	C	C	A		A	B	A	D	B	C	D		A
Ethyl Benzene							A		A	C	A	D			A
Ethyl Bromide	B	A		B	B		C	B		B	A	B	B		A
Ethyl Chloride, dry	B	B	B	B	A	A	A	B	B	C	A	C	B		A
Ethyl Chloride, wet	D	C	D	D	B		B	B	B	C	A	B	B		A
Ethylene Chloride	C				A		A	B	B	D	A		D		A
Ethylene Dichloride					B		A	B		D	C	D	D	A	A
Ethylene Glycol	A	B	B	B	B	A	A	B	A	A	A	A	A		A
Ethylene Oxide	C	C	B	B	B		B	B	A	D	A	D	D		A
Ethyl Ether	B	B		C	A		A	A	B	D	A	D	D		A
Ethyl Silicate	A	B		B	B		B	B		B	A	B	B		A
Ethyl Sulfate					B		B			B	A	C	A		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Fatty Acids	B	C	D	D	A		A	B	A	B	A	D	A	A	A
Ferric Hydroxide					A		A	A		B	A				A
Ferric Nitrate	D	D	D	D	C	B	A	D	B	A	A	A	A		A
Ferric Sulfate	D	D	D	D	B	B	A	D		A	A	A	A		A
Ferrous Ammonium Citrate	B				B		B				A				A
Ferrous Chloride	D	B	D	D	D		D	D	D	A	A	A	A	A	A
Ferrous Sulfate	C	B	D	D	B		B	B	B	A	A	A	A	A	A
Ferrous Sulfate, Saturated	C	C	C	C	A		A	B	B	C	A	B	B		A
Fertilizer Solutions	B	C	B	B	B		B	B		B					A
Fish Oils	C	B	B	B	A		A	A		A	A	D	A		A
Flue Gases	C	B		B	A		A	B		C	C	D	C		A
Fluoboric Acid	B				B		A			A	D				A
Fluorosilicic Acid	D	B	D	D	B		B	A	B	C	C	C	C		A
Formaldehyde, cold	A	A	A	B	A	A	A	A	B	B	A	B	D		A
Formaldehyde, hot	B	B	D	D	C		B	B	B	B	A				A
Formic Acid, cold	D	B	D	D	B	B	A	B	A	D	D		B	A	A
Formic Acid, hot	D	B	D	D	B	D	B	B	B	D	D		A	A	A
Freon Gas, dry	B	B	B	B	A	A	A	A	B	C	A	C	C	A	A
Freon 11, MF, 112, BF	B	B		C	A		A	B	B	C	A	C	D	A	
Freon 12, 13, 32, 114, 115	A	A		B	A		A	B	B	B	A	A	D	A	
Freon 21, 31	B	B		C	A		A	B	B	D	A	D	D	A	
Freon 22	A	A		B			A		B	D	A	D	D	A	
Freon 113, TF	B	B		C	A		A	B	B	B	A	C	C	A	
Freon, wet	D	D		D	C	B	B	B	B	B	A	B	D	A	A
Fruit Juices	B	B	D	D	A		A	B		A	A	A	A		A
Fuel Oil	A	B	B	B	A		A	B		A	A	D	A		A
Fumaric Acid							A			B	A				A
Furfural	A	A	A	B	A	B	A	B	B	D	A	C	D		A
Gallic Acid 5%	A	C	D	D	B		B	B	B	B	A	C	A		A
Gas, Manufactured	B	B	B	B	B		B	A		A	A		A		A
Gas, Natural	B	B	B	B	A		B	A		A	A	D	A		A
Gas, Odorizers	A	A	B	B	B		A	B		B	A		A		A
Gasoline, Aviation	A	A	A	B	A		A	A	A	C	A		A	A	A
Gasoline, Leaded	A	A	A	A	A		A	B	A	C	A		A	A	A
Gasoline, Motor	A	A	A	B		A	A	A	A	C	A	D	A	A	A
Gasoline, Refined	A	B	B	B	A		A	B	A	C	A	D	A	A	A
Gasoline, Sour	A	B	B	B	A		A	C	A	C	A	D	A	A	A
Gasoline, Unleaded	A	A	A	B	A		A	A	A	C	A		A	A	A
Gelatin	A	A	D	D	A		A	B		A	A	A	A		A
Glucose	A	A	B	B	A		A	A	A	A	A	A	A		A
Glue	A	B	A	B	B		A	B	A	A	A	B	A		A
Glycerine (Glycerol)	A	B	C	B	A	A	A	A	A	C	A	A	B	A	
Glycol Amine	C	D		B	B	A			D	A	C	D	D	A	
Glycol	A	B	C	B	B		A	B		B	C	A	A		A
Graphite	B	B		C	B		A	B		B	A	B	B		A
Grease	B	C	A	A	A		A	B		A	A	D	A		A
Helium Gas	B	B		B	A		A	B	A	B	A	B	B		A
Heptane	A	A	B	B	A		A	B	A	A	A	D	A		A
Hexane	A	B	B	B	A		A	B	A	A	A	D	A		A
Hexanol, Tertiary	A	A	A	A	A		A	A	A	A	A	D	B		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Hydraulic Oil, Petroleum Base	A	B	A	B	A		A	A		A	A	D	A		A
Hydrazine	C	D		D	B		B	A		C	D	B	D		A
Hydrocyanic Acid	A	D	D	C	A		A	D	B	B	D	B	A		A
Hydrofluosilicic Acid	D	A	D	D	C		B	D		B	A	B	A	A	A
Hydrogen Gas, cold	A	B	B	B	A		A			B	A	B	A		A
Hydrogen Gas, hot	C		B		B		A		A	B	A	B			A
Hydrogen Peroxide, Concentrated	A	D	D	D	B		B	D	D	D	D	B	B		A
Hydrogen Peroxide, Dilute	A	C	D	D	B		B	D	D	A	D	B	A		A
Hydrogen Sulfide, Dry	A	C	B	B	A	B	B	B	B	C	C	A	A	A	A
Hydrogen Sulfide, Wet	B	D	C	D	B		B	C	D	C	C	B	A	A	A
Hypo (Sodium Thiosulfate)	B	C	D	C	B		B	B		A	A	A	A		A
Illuminating Gas	A	A	A	A	A		A	A		C	A	D	A		A
Ink-Newsprint	C	C	D	D	A		A	B		A	A	B	A		A
Iodoform	C	C	B	C	A		A	C			A		A		A
Iso-Butane					B		B			B	A	D			A
Iso-Octane	A	A	A	B	A		A	A		A	A	D	A		A
Isopropyl Acetate					B		A			D	A	D		A	A
Isopropyl Ether	B	A	A	B	A		A	B	A	C	A	D	D	A	A
J P-4 Fuel	A	A	A	B	A		A	A	A	A	A		A		A
J P-5 Fuel	A	A	A	A	A		A	A	A	B	A		A		A
J P-6 Fuel	A	A	A	A	A		A	A	A	A	A		A		A
Kerosene	A	A	B	B	A		A	A	A	A	A	D	A	A	A
Ketchup	D	D	D	D	A		A	B		A	A		A		A
Ketones	A	A	A	A	A		A	A		D	A	D	D		A
Lacquer (and Solvent)	A	A	C	C	A		A	A		D	A	D	D		A
Lactic Acid Concentrated Cold	C	D	D	D	A	D	A	D	A	B	D	B	A	A	A
Lactic Acid Concentrated Hot	C	D	D	D	B	D	A	D	B	C	D	B	B	A	A
Lactic Acid Dilute Cold	A	D	D	D	A	B	A	C	A	B	D	B	A	A	
Lactic Acid Dilute Hot	B	D	D	D	A	D	A	D	B	C	D		D	A	A
Lactose	B	B		C	B		B	B		B	A	B	B		A
Lard	A	B		A	A		A			B	A	C			A
Lard Oil	B	B	C	C	B		A	B		A	A	B	A		A
Lead Acetate	D	C	D	D	B		B	B		A	A	B	B		A
Lead Sulfate	D	C		D	B		B	B		B	A	B	B		A
Lecithin	C	C		C	B		B	B		D	A	D	B		A
Linoleic Acid	A	B	B	B	A		A	B		B	A	D	B		A
Linseed Oil	A	B	A	A	A		A	B		A	A	D	A		A
Lithium Chloride	D	B		B	B		A	B		B	A	B	B		A
LPG	A	A	B	B	B		B	B		A	A	D	A		A
Lubricated Oil Petroleum Base	A	B	A	A	A		A	B		A	A	D	A		A
Ludox	D	D		B	B		B	B		B	B	B	B		A
Magnesium Bisulfate	B	B	B	B	A		A	B		B	A	B	B		A
Magnesium Bisulfide	C	D		D	B		B	B		B	A	B	B		A
Magnesium Carbonate	B	B		B	A		A	B		B	A	B	B		A
Magnesium Chloride	D	B	C	D	B	C	B	B	A	A	A	A	A		A
Magnesium Hydroxide	D	B	B	B	A	A	A	B	B	A	A	A	A		A
Magnesium Hydroxide Hot	D	D	B	B	A	A	A	A	B	B	A		A		A
Magnesium Nitrate	B				A		A	B		B	A		B		A
Magnesium Sulfate	B	B	B	B	A	A	A	B	A	A	A	A	A		A
Maleic Acid	B	B	B	C	B		B	B	A	B	A	D	A		A

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Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Maleic Anhydride	B	B		B	B		B	B	B	D	C	D	B		A
Malic Acid	B	B	D	D	B		B	B		A	A		A		A
Malt Beverages					A		B	A		A	A	B	A		A
Manganese Carbonate	B				B		A			B	A				A
Manganese Sulfate	B	B		D	A		A	B		B	A	B	B	A	A
Mayonnaise	D	D	D	D	A		A	B		A	A		A		A
Meat Juices	B	D			A		A			B	A				A
Melamine Resins				D	C		C			B	A				A
Methanol	B	B		B	A		A	B		B	C	D	B		A
Mercuric Chloride	D	D	D	D	B		B	D	B	A	A	A	A		A
Mercuric Cyanide	D	D	D	D	A		A	C	B	A	A	A	A		A
Mercuric Nitrate	D	D			A		A	D			A		B		A
Mercury	D	D	A	A	A		A	B	B	A	A	A	A		A
Methane	A	A	B	B	A		A	B	A	A	A		A		A
Methyl Acetate	A	A	B	B	A		A	B	A	D	B	B	D		A
Methyl Acetone	A	A	A	A	A		A	A		D	B	A	D		A
Methylamine	A	D	B	B	A		A	C	B	D	A	B	D		A
Methyl Bromide 100%	C	C		D	B		A	B		B	A	D	B		
Methyl Cellosolve	A	A	B	B	A		A	B	B	C	A	B	D		A
Methyl Cellulose					A		A		B	D	A				A
Methyl Chloride	D	B	B	B	A		A	B		D	A	D	B		A
Methyl Ethyl Ketone	A	A	A	A	A		A	A	B	D	A	B	D	A	A
Methyl Chloride	C	A	B	B	A		A	B	B	D	A	D	C		A
Methyl Formate	C	A	C	C	B		A	B	B	D	A	B	D		A
Methyl Isobutyle Ketone					A		A			D	A			A	A
Milk and Milk Products	A	B	D	D	A		A	B		A	A	A	A		A
Mineral Oils	A	B	B	B	A		A	A		A	A	D	A		A
Mineral Spirits	A	B	B	B	B		B	B		A	A		A		A
Mixed Acids (cold)	D	D	C	C	B		B	C		D	D	D	B		A
Molasses, crude	B	A	A	A	A		A	A		A	A		A		A
Molasses, Edible	A	A	C	C	A		A	A		A	A		A		A
Molybdic Acid					A		A				A				A
Monochloro Benzene Dry					B		B	B		D	C			A	A
Morpholine	B	B		B	A		A	B		D	A	B	D		A
Mustard	B	A	B	B	A		A	A		A	A		A		A
Naptha	A	B	B	B	B		B	B	A	B	A	D	A		A
Napthalene	B	B	B	B	B		B	B	B	D	A	D	A		A
Natural Gas, Sour	B	B	B	B	A		A	D	A	A	A	D	A		A
Nickel Ammonium Sulfate	D	D	D	D	A		A	C		A	C	B	D		A
Nickel Chloride	D	D	D	D	B		A	B	A	A	D	B	A	A	A
Nickel Nitrite	C	D	D	D	B		A	B		A	C	A	A		A
Nickel Sulfate	D	D	D	D	B		A	B	B	A	C	B	A	A	A
Nicotinic Acid	A	A	B	C	A		A	A		D	C	D	B		A
Nitric Acid 10%	D	D	D	D	A	A	A	D		C	D		A	A	A
Nitric Acid 30%	D	D	D	D	A	D	A	D		C	D	B	A	B	A
Nitric Acid 80%	B	D	D	D	C	D	B	D		D	D	B	B	B	A
Nitric Acid 100%	B	D	D	D	A	D	A	D		D	D	D	B	B	A
Nitric Acid Anhydrous	B	D	D	D	A	D	A	D		D	D	D	A	B	A
Nitrobenzene	C	D	B	B	A		A	B	B	D	B	C	C		A
Nitrogen	A	A	A	A	A		A	A		A	A	B	A		A

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Nitrous Acid 10%	D	D	D	D	B		B	D		C	B		A		A
Nitrous Gases	B	D	B	C	A		A	D			B				A
Nitrous Oxide	C	B	B	C	B		B	D	B	B	A		A		A
Oils & Fats	B				A		A			B	A	D			A
Oils, Animal	A	A	A	A	A		A	B	A	A	A	B	B		A
Oils, Petroleum Refined	A	B	A	A	A		A	A	A	A	A	D	A		A
Oils, Petroleum Sour	A	C	B	C	A		A	A	A	B	A	D	A		A
Oils, Water Mixture	A	A	B	B	A		A		A	A	A		A		A
Olaic Acid	B				B		B	A		D	C		C		A
Oleic Acid	B	B	C	C	B		A	B	B	B	C	D	A	A	A
Oleum	B	C	B	D	B		B	C	B	D	D	D	C		A
Oleum Spirits	D	D		D	B		B	D		C	D	D	A		A
Olive Oil	B	C	B	B	A		A	A		A	A	B	A		A
Oxalic Acid	C	B	D	D	B	D	B	B		C	C	B	A	A	A
Oxygen	A	A	B	B	A	A	A	A	A	B	D	A	A		A
Ozone, Dry	A	A	A	A	A		A	A	A	D	C	A	B		A
Ozone, Wet	B	B	C	C	A		A	A	A	D	C	B	B		A
Paints & Solvents	A	A	A	A	A		A	A		D	A	D	B		A
Palmitic Acid	B	B	C	C	B		B	B		B	A	B	A		A
Palm Oil	A	B	C	C	B		A	A		B	A	D	A		A
Paper Pulp	D	B		B	A		A	B		B	A	B	B		
Paraffin	A	A	B	B	A		A	A	A	A	A	D	A		A
Paraformaldehyde	B	B	B	B	B		B	B		B	A	D			A
Paraldehyde					B		B			B	A	D		A	A
Pentane	A	A	B	B	A		A	B		A	A	D	A		A
Perchloroethylene, dry	B	C	B	B	A		A	B	B	D	B	D	A		A
Petroleum (Vaseline Petroleum Jelly)	B	B	C	C	B		A	A		A	A		A		A
Phenol	A	B	D	D	A	B	A	A	A	D	C	D	B		A
Phosphate Ester 10%	D	D	A	A	A		A	A		D	A	A			A
Phosphoric Acid 10%	D	D	D	D	D	B	B	D		B	D	B	A	A	A
Phosphoric Acid 50% Cold	D	D	D	D	B	B	B	C		B	D	B	A	A	A
Phosphoric Acid 50% Hot	D	D	D	D	D	D	B	C		B	D	B	A	A	A
Phosphoric Acid 85% Cold	D	D	B	B	A	C	B	A		C	D		B	A	A
Phosphoric Acid 85% Hot	D	D	C	C	B	D	B			C	D			A	A
Phosphoric Anhydride	A				A		A			D	B		B	A	A
Phosphorous Trichloride	D		B	C	A		A			D	D	B	B	A	A
Phthalic Acid	B	B	C	C	B		B	A	B	C	B		A		A
Phthalic Anhydride	B	B	C	C	B		B	A	A	C	A		A		A
Picric Acid	C	C	D	D	B	C	B	D	B	C	D	B	B		A
Pineapple Juice	A	C	C	C	A		A	A		A	A		A		A
Pine Oil	B	B	B	B	A		A	B		A	A	D	A		A
Pitch (Bitumen)					A		A			C	A	D			A
Polysulfide Liquor	D	D		B	B		A	B		B	D	B	B		A
Polyvinyl Acetate	B	B		B	B		B	B			A	B			A
Polyvinyl Chloride	B	B		B	B		B	B			A	B			A
Potassium Bicarbonate	A				A		A	B		B	A				A
Potassium Bichromate	A				A		A	A		B	B		B		A
Potassium Bisulfate	B				A		A	B		B	A		A		A
Potassium Bisulfite	C	C	D	D	B		B	D		A	A	B	A		A
Potassium Bromide	C	C	D	D	A	C	B	B		A	A	B	A		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Potassium Carbonate	D	B	B	B	B	A	B	B		A	A	B	A		A
Potassium Chlorate	C	B	B	B	B	B	B	C		A	A	B	A		A
Potassium Chloride	D	C	C	B	B	B	A	B	B	A	A	A	A		A
Potassium Chromate	B	B		B	B		B	B		B	A	B	B		A
Potassium Cyanide	D	D	B	B	B		B	B	B	A	A	A	A		A
Potassium Dichromate	A	D	C	C	B		A	B		A	A	B	A		A
Potassium Ferricyanide	B	D	C	C	A	B	B	B		A	A	B	A		A
Potassium Ferrocyanide	B	B	C	C	B		B	A		A	A		A		A
Potassium Hydroxide Dilute Cold	D	D	A	A	B	B	B	A		A	D		D		A*
Potassium Hydroxide To 70%, Cold	D	D	B	B	B	C	B	A		B	D	B	D		A*
Potassium Hydroxide Dilute Hot	D	D	B	B	B	C	B	A		B	D				A*
Potassium Hydroxide To 70%, Hot	D	D	A	B	B	D	B	A		C	D	A			A*
Potassium Iodine	D	D	C	C	B	B	B	C		A	A	B	A		A
Potassium Nitrate	A	B	B	B	B	B	B	B	B	A	A	B	A		A
Potassium Oxalate	C				A		A				A				A
Potassium Permanganate	B	B	B	B	B	B	B	B	B	A	A	B	A		A
Potassium Phosphate	D	C		C	B		B	B	B	A	A	A	A		A
Potassium Phosphate Di-basic	B	B	A	A	A		A	B	B	A	A	B	A		A
Potassium Phosphate Tri-basic	D		A	A	B		B	B		B		B			A
Potassium Sulfate	A	B	B	C	A	A	A	B		A	A	A	A		A
Potassium Sulfide	B	B	B	B	A		A	C	A	A	A	B	B		A
Potassium Sulfite	B	B	B	B	A		A	C	B	B	A	A	B		A
Producer Gas	B	B	B	B	B	A	B	A		A	A	D	A		A
Propane Gas	A	A	B	B	B	A	A	B	A	A	A	D	A		A
Propyl Bromide	B	B		B	B		A	B		B	A	B	B		A
Propylene Glycol	A	B	B	B	B		B	B		A	C	B	A		A
Pyridine	B			B	B		A			D	D		D		A
Pyrolgalic Acid	B	B	B	B	B	B	A	B		A	A		A		A
Quench Oil	A	B	B	B	A		A			A	A		A		A
Quinine, Sulfate, dry					A	B	A	B			A				A
Resins & Rosins	A	A	C	C	A	B	A	A		C	A		A		A
Resorcinol					B		B								A
Road Tar	A	A	A	A	A		A	A		B	A	D	A		A
Roof Pitch	A	A	A	A	A		A	A		B	A		A		A
Rosin Emulsion	A	B	C	C	A		A	A		D	A		B		A
R P-1 Fuel	A	A	A	A	A		A	A		B	A		A		A
Rubber Latex Emulsions	A	A	B	B	A		A				A		A		A
Rubber Solvents	A	A	A	A	A		A	A		D	C		D		A
Salad Oil	B	B	C	C	B		A	B		A	A	B	A		A
Salicylic Acid	C	C	D	D	A		B	B		A	A	B	A		A
Salt (NaCl)	B	B	C	C	B		A	A		A	A		A		A
Salt Brine	B	B		D	B		B	B		A	A	B	B		A
Sauerkraut Brine					B		B				C				A
Sea Water	C	C	D	D	B		B	A		A	A	A	A		A
Sewage	C	C	C	D	B	A	B	B		A	B	B	B		A
Shellac	A	A	A	B	A		A	A		A	A				A
Silicone Fluids	B	B		B	B		B			B	A		B		A
Silver Bromide	D				A	C	A	B			D				A
Silver Cyanide	D	D		D	A		A	B		B	D		B		A
Silver Nitrate	D	D	D	D	A		A	D		C	A	A	A		A

Ratings: **A -** Excellent **B -** Good **C -** Poor **D -** Do not use **Blank -** No information *** -** Not with Reinforced or Polyfill

Corrosion Data

Chemicals	Aluminum	Brass	Carbon Steel	Ductile Iron/Cast Iron	316 Stainless Steel	17-4PH	Alloy 20	Monel	Hastelloy C	Buna-N (Nitrile)	Delrin	EPDM/EPR	Viton	Flexible Graphite	Teflon-Reinforced/ or NRG
Silver Plating Sol.	B				A		A				D				A
Soap Solutions (Stearates)	C	A	A	B	A		A	A		A	A	A	A		A
Sodium Acetate	B	B	C	C	B		B	B	B	B	A	B	A		A
Sodium Aluminate	D	B	C	C	A		B	B	B	A	A	B	A		A
Sodium Benzoate	B				B		B	B			B				A
Sodium Bicarbonate	B	B	C	C	B		A	B		A	B	A	A		A
Sodium Bichromate	A				B		B			D	A				A
Sodium Bisulfate 10%	D	B	D	D	A		A	B		A	D	B	A		A
Sodium Bisulfite 10%	D	B	D	D	A		B	B	B	A	D	B	A		A
Sodium Borate	B	B	C	C	B		B	B		A	A	B	A		A
Sodium Bromide 10%	B	B	C	D	B		B	B		A	A	B	A		A
Sodium Carbonate (Soda Ash)	D	B	B	B	A		A	B	B	A	A	B	A		A
Sodium Chlorate	C	B	C	C	B		B	C	B	A	A	B	A	B	A
Sodium Chloride	B	B	C	C	B		A	A	B	A	A	B	A	A	A
Sodium Chromate	D	C	B	B	A		B	B		A	A	B	A		A
Sodium Citrate	D				B		B				A				A
Sodium Cyanide	D	D	B	B	A	B	A	B		A	A	B	A		A
Sodium Ferricyanide	A				A		A	B			A				A
Sodium Fluoride	C	C	D	D	B	B	A	B		A	A	B	A		A
Sodium Hydroxide 20% Cold	D	A	A	A	A	A	B	A		A	D	B	B	A	A*
Sodium Hydroxide 20% Hot	D	A	B	B	A	C	A	A		B	D	B	C	A	A*
Sodium Hydroxide 50% Cold	D	A	A	B	A	B	A	A		A	D	B	C	A	A*
Sodium Hydroxide 50% Hot	D	A	B	B	A	C	A	B		B	D		C	A	A*
Sodium Hydroxide 70% Cold	D	A	A	A	A	B	B	A		B	D	B	C	A	A*
Sodium Hydroxide 70% Hot	D	B	B	B	A	C	B	B		D	D	B	C	A	A*
Sodium Hypochlorite (Bleach)	D	D	D	D	D	D	C	D	A		D		A		A
Sodium Hyposulfite	B				B		B	B			A				A
Sodium Lactate	D				A		A	B			A				A
Sodium Metaphosphate	A	C	B	C	B	B	B		A	A	B	B		A	
Sodium Metasilicate Cold	B	B	C	C	A		A	A		B	A		B		A
Sodium Metasilicate Hot	B	B	D	D	A		A	A	A		A				A
Sodium Nitrate	A	B	B	B	A	B	A	B	B	C	A	B	A		A
Sodium Nitrite	A				B		B	C	B	C	B	A	B		A
Sodium Perborate	B	B	B	B	B	B	B	B	B	C	A	A	A		A
Sodium Peroxide	C	D	C	C	B	B	B	B	B	C	A	A	A		A
Sodium Phosphate	D	C	C	C	B	B	B	B	B	B	B	A	A		A
Sodium Phosphate Di-basic	D	C	C	C	B		B	B	B	A	A	A	A		A
Sodium Phosphate Tri-basic	D	C	C	C	B		B	B	B	B	A	A	A		A
Sodium Polyphosphate					B		B	B	B	B		A			A
Sodium Salicylate					A		A				A				A
Sodium Silicate	B	B	B	B	B		B	B		A	A	B	A		A
Sodium Silicate, Hot	C	C	C	C	B		B	B			A	B			A
Sodium Sulfate	B	B	B	B	A	B	A	A		A	A	A	A		A
Sodium Sulfide	C	D	B	B	B	A	B	B		A	A	B	A		A
Sodium Sulfite	B	C		A	A	A	A	B	B	A	A	B	B		A
Sodium Tetraborate				A	A		A			A	A	B			A
Sodium Thiosulfate	B	C	B	C	B	A	B	B		A	A	A	A		A
Soybean Oil	B	B	C	C	A		A	A		A	B	B	A		A
Starch	B	B	C	C	B		A	A		A	A	C	A		A
Steam (212° F)	A	A	A	A	A	A	A	B		D	D	B	C	A	A

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