City of Cleveland
Justin M. Bibb, Mayor

Department of Finance
Division of Purchases & Supplies
601 Lakeside Avenue, Room 128
Cleveland, Ohio 44114-1080
216/664-2620 • Fax: 216/664-2177
www.cleveland-oh.gov

November 18, 2024

ADDENDUM 2

BID TITLE: File No. 121-24 Treatment Plant Residual Systems Improvements

BID DUE: Thursday, December 12, 2024 at 12 o'clock noon (Eastern Time)

Attention Bidders:

We have been requested to issue the addendum for the following:

Please ensure that a copy of this addendum is included and returned with the bid specifications furnished to you by this office, as it will have the same force and effect as if it were part of the specifications originally issued.

1. Changes to the Bid – Schedule of Items.
2. Changes to Part D – Technical Specifications.
3. Add New Appendices.
4. Changes to the Contract Drawings.
5. Answers to questions received.

If you have any questions regarding the attached, please contact Jules Gilliam at jgilliam@clevelandohio.gov. Thank you for your prompt attention and assistance in this matter.

Also, please ensure that copy of this addendum is included and returned with the bid specifications furnished to you by this office, as it will have the same force and effect as if it were part of the specifications originally issued.

_____ _____

Signature of Potential Bidder & Name of Company Today's Date

Thank you,

Donia Patterson, Assistant Administrator
Purchases & Supplies

TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS – FILE NO. 121-24

ADDENDUM NO. 2

The bid due date is December 12, 2024, and bids must be date stamped by 11:59 a.m. that day.

The last day for questions is December 3, 2024 by 12:00 p.m.

Changes to the Bid – Schedule of Items:

1. Replace the original Bid – Schedule of Items pages with the attached Addendum No. 2 Bid – Schedule of Items pages. Bid Item 19 has been added.

Changes to Part D – Technical Specifications:

1. Section 01 10 00 - Summary Of Work, Page 01 10 00-2, Paragraph 1.2.A.4.a.2):

   Delete "stormwater sump pumps, piping, supports, and valves;".

2. Section 01 29 00 - Measurement And Payment, Page 01 29 00-7:

   Insert Paragraph 1.3.S as follows:

   "S. Bid Item 19: Baldwin Anthracite Removal Allowance

      1. Item 19: Contract for all Work as specified and shown.

         a. Description: Item 19: Baldwin Anthracite Removal Allowance shall be in the amount of $900,000.00 (nine hundred thousand dollars) to be used at the discretion of the City to reimburse the Contractor for costs to complete Baldwin Anthracite Removal that is not included in the Contract Documents. The Contractor shall remove the anthracite from Attenuation Basins 1A, 1B, 2A, and 2B (four basins).

         b. Contractor shall be responsible for its own errors of workmanship, improper Work scheduling and delay, etc., and this allowance shall not be used to compensate for that responsibility.

         c. Payment: The Contractor will be compensated for Work performed under Item 19 in accordance with the procedures set forth in the Contract Documents. All remaining funds at the end of the Contract will be deducted by change order."

3. Section 01 21 00 - Allowances, Page 01 21 00-3:

   Insert Paragraph 3.3.C as follows:

   "C. Baldwin Anthracite Removal Allowance will be an allowance amount for the sum of $900,000.00 (Nine Hundred Thousand Dollars) to cover all costs associated with material, equipment, and labor as necessary to address Baldwin Anthracite Removal.

The Contractor shall remove the anthracite from Attenuation Basins 1A, 1B, 2A, and 2B (four basins). The Contractor shall not assume that this amount will be made part of the contract amount nor shall he purchase materials or perform Work under this item without approval from CWD."

4. Section 22 14 29 - Sump Pumps, Page 22 14 29-3, Paragraph 2.3:

   Delete the sump pump table in its entirety and replace with new table as follows:

	SP-1 & 2	SP-3 & 4	SP-5 & 6	SP-7 & 8
LOCATION	PUMP CHAMBER 2	PUMP CHAMBER 3	CLARIFIER PUMP BUILDING	ATTENUATION BASIN PUMP BUILDING
SERVICE	STORMWATER	STORMWATER	SANITARY	SANITARY
PUMP TYPE	Submersible	Submersible	Submersible	Submersible
CAPACITY (GPM)	430	430	60	60
TOTAL HEAD (FT WATER)	64	64	55	70
FLUID TEMP (°F)	40	40	40	40
DISCHARGE SIZE	4-inch	4-inch	2-inch	2-inch
MOTOR HP	15	15	2	5
RPM	1750	1750	3450	3450
ELECTRICAL VOLTAGE	460V	460V	208V	208V

5. Section 40 70 05 - Primary Sensors And Field Instruments, Page 40 70 05-5:

   Delete Paragraph 2.3.C.5 in its entirety.

   Insert Paragraph 2.3.E.4 as follows:

   "4. Sensors shall be equipped with self-cleaning face wipers."

Add New Appendices:

1. Appendix H – Crown Residuals Improvements Record Drawing E-17.
2. Appendix I – Residuals Handling Building Seal Water Skid Existing Control Panel Information.
3. Appendix J – Attenuation Basin Pump Building Seal Water Skid Existing Control Panel Information.

Changes to the Contract Drawings:

1. Sheet S-1, Detail A, Note 1: Delete "A25406" and replace with "A2540".
2. Sheet C-M-2: Revise drawing per Sketch SK-1 (attached).

3. Sheet C-M-3: Delete Note 9 and replace with new Note 9 as follows:

   "9. Remove 6" SK-DI from skimmings beach to last flange in the tank and prep flange for installation of screen. See Sheet C-M-2 for demolition work in the pump room."

4. Sheet C-M-11: Revise drawing per Sketch SK-2 (attached).

5. Sheet C-M-12: Revise drawing per Sketch SK-3 (attached).

6. Sheet C-E-10: Insert Note 5 as follows:

   "5. Refer to Appendices for location of PLC 6A (PCM 6A), MCC-2, and MCC-4 in the sludge dewatering building."

7. Sheet C-E-11, GST sludge blanket controller detail: Delete "& guard" from the "SS transducer mount & guard" callout.

8. Sheet C-E-11, GST sludge blanket controller detail: Delete the guard shown on the left side of the transducer.

9. Sheet N-E-9: Insert Note 2 as follows:

   "2. Contractor shall verify existing sump pump voltages and fuse sizes. Panel schematic shown is for 208V panels. 460V panels are similar. Refer to sump pump usage table for panel voltage at each location.".

10. Sheet N-E-9: Delete Sump Pump Usage Table and Replace with new Sump Pump Usage Table as follows:

SUMP PUMP USAGE TABLE				
LOCATION	EQUIPMENT	HP	VOLTAGE	FUSE SIZE
RESIDUALS HANDLING BUILDING	STORMWATER SUMP PUMP 1	1.5	460	15
RESIDUALS HANDLING BUILDING	STORMWATER SUMP PUMP 2	1.5	460	15
FLOC STALL 1	STORMWATER SUMP PUMP 1	20	460	50
FLOC STALL 1	STORMWATER SUMP PUMP 2	20	460	50
FLOC STALL 1	SANITARY SUMP PUMP 1	2	460	15
FLOC STALL 1	SANITARY SUMP PUMP 2	2	460	15
FLOC STALL 2	STORMWATER SUMP PUMP 1	15	460	40
FLOC STALL 2	STORMWATER SUMP PUMP 2	15	460	40
FLOC STALL 2	SANITARY SUMP PUMP 1	2	460	15
FLOC STALL 2	SANITARY SUMP PUMP 2	2	460	15
FLOC STALL 3	STORMWATER SUMP PUMP 1	15	460	40
FLOC STALL 3	STORMWATER SUMP PUMP 2	15	460	40
FLOC STALL 3	SANITARY SUMP PUMP 1	2	460	15
FLOC STALL 3	SANITARY SUMP PUMP 2	2	460	15
ATTENUATION BASIN PUMP BLDG	SANITARY SUMP PUMP 1	5	208	20
ATTENUATION BASIN PUMP BLDG	SANITARY SUMP PUMP 2	5	208	20
CLARIFIER PUMP BUILDING	STORMWATER SUMP PUMP 1	2	208	15
CLARIFIER PUMP BUILDING	STORMWATER SUMP PUMP 2	2	208	15

CLARIFIER PUMP BUILDING	SANITARY SUMP PUMP 1	2	208	15
CLARIFIER PUMP BUILDING	SANITARY SUMP PUMP 2	2	208	15

Answers to questions received:

1. Will removal of the domes on the Crown backwash clarifiers be allowed to accommodate the work within the tanks?

   Answer: No, domes shall not be removed due to concerns regarding structural integrity.

2. Are all the Crown pressure relief valves from the same manufacturer?

   Answer: Unknown. Contractor shall field verify during construction.

3. For the Crown replacement drives, is there a manufacturer warranty for the drives previously procured by the City?

   Answer: No. The services of a factory representative are specified in Section 46 43 31 - Circular Secondary Clarifier Equipment to inspect the final installation and supervise a test run of the equipment.

4. Which Crown backwash clarifier should be taken out of service first?

   Answer: Backwash Clarifier No. 1 shall be the first backwash clarifier to be taken out of service.

5. At Baldwin, what will be refurbished, replaced, and checked during the rebuild of the sludge recirculation pumps in the sludge discharge pump station?

   Answer: Refer to Section 43 23 33 - End Suction Solids Handling Pumps, Page 43 23 33-9.

6. Specification Section 40 70 05 – Primary Sensors and Field Instruments.

   Paragraph 2.3 – Sludge Level Transmitters – Ultrasonic Type

   1) Units are called out to be Class 1 Div. 1 Ex-proof. This adds costs that we don't think are required in a Water Treatment Plant and Entech cannot provide. Please confirm.
   2) The transducers appear to be shown with the optional flex mount and guard, which is used when there is a skimmer arm or flight. Do the GSTs have skimmers? If not, then we'll need to provide transducers with wipers.

   Answer: See Changes to Part D – Technical Specifications - No. 5.

7. Residual Handling Bldg. – Scope of Work (Note 2) – Calls to replace stormwater sump pump, piping, supports and valves. Shown in specs but nothing shown on the drawings to for this work. Please clarify.

Answer: See Changes to Part D – Technical Specifications – No. 1.

8. On drawing S-1 (Detail A) Troy Part # A25406 does not exist... The largest PRV troy makes is 8" ... Please advise

   Answer: See Changes to Part D – Technical Specifications – No. 1.

9. Drawing N-E-9 has a sump pump usage table for all the sump pumps being replaced. There is not a usage table for the existing sump pumps being replaced, which are getting new control panels. This information is needed to correctly build the sump pump control panels. Information requested is for the following sump pump panels.
   - Residual Handing (N-E-2) Stormwater sump pumps
   - Floc Stall 1 (N-E-4) Stormwater and Sanitary sump pumps
   - Floc Stall 2 (N-E-4) Sanitary sump pumps
   - Floc Stall 3 (N-E-4) Sanitary sump pumps
   - Clarifier Building (N-E-8) Stormwater sump pumps

   Answer: See Changes to the Contract Drawings – No. 10.

10. The schematic on N-E-9 indicates that the sump pump voltage is 208V. Spec section 22 14 29, pg.3, 2.3 indicates that the voltage is 460V. Please confirm the correct voltage.

    Answer: See Changes to the Contract Drawings – No. 9.

11. Please provide more information on the Seal Water Skid Control Panels, 40 95 14, pg.10, 2.10. A schematic will be helpful or a photo for the outside/inside of the existing panel and the voltage.

    Answer: See Add New Appendices – No. 2.

CITY OF CLEVELAND – DEPARTMENT OF PUBLIC UTILITIES
TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS
ADDENDUM NO. 2 - BID – SCHEDULE OF ITEMS - FILE NO. 121-24

BID ITEM NO.	DESCRIPTION	UNIT	QUANTITY Q	UNIT PRICES			TOTAL PRICE FOR ITEM Q x T
				MATERIAL M	LABOR L	TOTAL M + L = T	
1	Mobilization and Demobilization	LS	1	NA	NA		
2	Baldwin Process Mechanical Work	LS	1	NA	NA		
3	Baldwin Residuals Mixing Chamber Sludge/Grit Removal and Disposal	CF	1,200				
4	Baldwin Electrical/I&C Work	LS	1	NA	NA		
5	Baldwin Sludge Storage Tank Geodesic Dome Sealant Removal and Replacement	LF	3,500				
6	Crown Backwash Water Clarifier Geodesic Dome Sealant Removal and Replacement	LF	20,000				
7	Crown Process Mechanical Work	LS	1	NA	NA		
8	Crown Structural Work	LS	1	NA	NA		
9	Crown Electrical/I&C Work	LS	1	NA	NA		
10	Crown Geodesic Domes for Gravity Sludge Thickeners	LS	4	NA	NA		
11	Crown Access Bridge Beam – Top Flange Repair	LF	100				
12	Crown Access Bridge Beam – Bottom Flange Repair	LF	100				
13	Nottingham Process Mechanical Work	LS	1	NA	NA		
SIGNATURE OF BIDDER _____				DATE _____			
NAME OF COMPANY _____				PAGE 1 OF 2			

CITY OF CLEVELAND – DEPARTMENT OF PUBLIC UTILITIES
TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS
ADDENDUM NO. 2 - BID – SCHEDULE OF ITEMS - FILE NO. 121-24

BID ITEM NO.	DESCRIPTION	UNIT	QUANTITY Q	UNIT PRICES			TOTAL PRICE FOR ITEM Q x T
				MATERIAL M	LABOR L	TOTAL M + L = T	
14	Nottingham Electrical/I&C Work	LS	1	NA	NA		
15	As-built Drawings	LS	1	NA	NA	$5,000	$5,000
16	Pre-construction Photos and Video and Construction Photos	LS	1	NA	NA		
17	Unforeseen Work Allowance	ALLOW	1	NA	NA	$300,000	$300,000
18	Unforeseen Structural Repair Allowance	ALLOW	1	NA	NA	$200,000	$200,000
19	Baldwin Anthracite Removal Allowance	ALLOW	1	NA	NA	$900,000	$900,000
	UNOFFICIAL TOTAL FOR ALL BID ITEMS						
	CONTINGENCY ALLOWANCE PER SECTION B-34: (10% OF UNOFFICIAL TOTAL FOR ALL BID ITEMS)						
	UNOFFICIAL BID TOTAL: (UNOFFICIAL TOTAL FOR ALL BID ITEMS PLUS CONTINGENCY ALLOWANCE)						

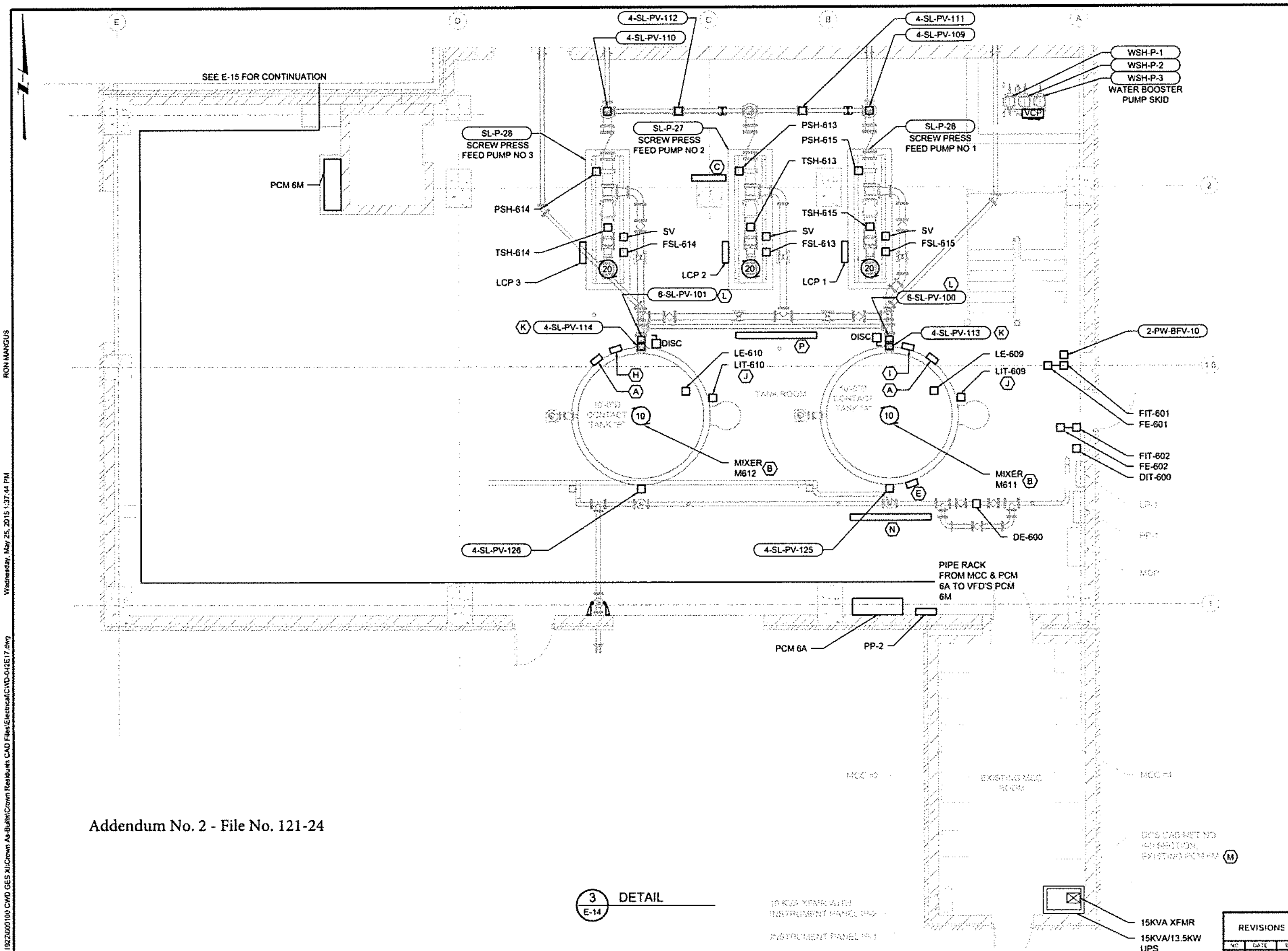
BID PRICE INCLUDES THE FOLLOWING ADDENDA:

		Addendum No.	Date:		

SIGNATURE OF BIDDER _____ DATE _____

NAME OF COMPANY _____ PAGE 2 OF 2

APPENDIX H – CROWN RESIDUALS IMPROVEMENTS RECORD DRAWING E-17



Addendum No. 2 - File No. 121-24

GENERAL SHEET NOTES

1. PROVIDE AND INSTALL 30A, NON-FUSED, NEMA 4X 316 STAINLESS STEEL DISCONNECT FOR ALL 480V, 3PH CONTROL VALVES.
2. PROVIDE AND INSTALL DISCONNECT FOR ALL 120V, 1PH VALVES AS PER DETAIL E-915 ON DRAWING GE-4.

SHEET KEYNOTES

A. EXISTING LCP FOR CONTACT TANK MIXER
   1. REROUTE AND CONNECT EXISTING PLC CONTROL WIRING TO NEW PLC 6A.

B. RECONNECT EXISTING POWER FEED FROM EXISTING MIXER DRIVE TO NEW DRIVE.

C. REMOTE VALVE STATION AND DISCONNECT FOR: (SEE DETAIL E-910 ON DRAWING GE-4)
   1. 4-SL-PV-109
   2. 4-SL-PV-110
   3. 4-SL-PV-111
   4. 4-SL-PV-112

D. REMOTE VALVE STATION AND DISCONNECT FOR: (SEE DETAIL E-910 ON DRAWING GE-4) MOVED SEE-N
   1. 4-SL-PV-126

E. REMOTE VALVE STATION AND DISCONNECT FOR: (SEE DETAIL E-910 ON DRAWING GE-4) MOVED SEE-N
   1. 4-SL-PV-125

F. DELETED

G. WALL MOUNTED REMOTE VALVE STATION AND DISCONNECT.
   1. 2-PW-BFV-10 MOVED SEE-N

H. REMOTE VALVE STATION AND DISCONNECT FOR: (SEE DETAIL E-910 ON DRAWING GE-4) MOVED SEE-P
   1. 4-SL-PV-114

I. REMOTE VALVE STATION AND DISCONNECT FOR: (SEE DETAIL E-910 ON DRAWING GE-4) MOVED SEE-P
   1. 4-SL-PV-113

J. CONNECT EXISTING LIT CIRCUIT FROM PANEL IP-1, CKT-15 TO NEW LITS. SEE DRAWING E-2.

K. VALVES ARE LOCATED ON UPPER PIPING.

L. VALVES ARE LOCATED ON LOWER PIPING.

M. RETAIN PCM 6M FOR ETHERNET SWITCH ONLY.

N. R-V-S- AND DISCONNECT RACK FOR
   1. BV-10
   2. FIT/FE-602
   3. FIT/FE-601
   4. DIT-600
   5. 4-SL-PV-125
   6. 4-SL-PV-126
   7. DIT ADD ON

P. R-V-S- AND DISCONNECT RACK FOR
   1. 4-SL-PV-113
   2. 4-SL-PV-114
   3. 6-SL-PV-100
   4. 6-SL-PV-101

RECORD DRAWING

NOTE: THIS RECORD DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED BY OTHERS. DLZ OHIO, INC HAS NOT VERIFIED THE ACCURACY AND/OR COMPLETENESS OF THIS INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED AS A RESULT.

BY: DLZ OHIO, INC
DATE: FEBRUARY, 2021

WARNING
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

Stantec

RECORD

REVISIONS

Crown Residuals Improvements

CLEVELAND DIVISION OF WATER
DEPARTMENT OF PUBLIC UTILITIES
CLEVELAND, OHIO

ELECTRICAL

SLUDGE DEWATERING BUILDING

GROUND FLOOR PLAN - II

E-17 | 113866 | 153/166

DWG FILE: X:\Projects\GFL\2019\1922600100 CWD GES XI\Crown As-Built\Crown Residuals CAD Files\Electrical\CWD-042E17.dwg
Wednesday, May 25, 2016 1:37:44 PM
RON MANGUS

APPENDIX I - RESIDUALS HANDLING BUILDING SEAL WATER SKID EXISTING CONTROL PANEL INFORMATION

Addendum No. 2 - File No. 121-24

INSTRUCTION MANUAL

Master Control Systems, Inc. "M-PLEX" Series

Pump Motor Controllers

– for –

Models SPX, DPX, TPX & QPX

Simplex, Duplex, Triplex and Quadraplex

Table of Contents

Addendum No. 2 - File No. 121-24

M-PLEX Series -of- Booster Pump Motor Controller

General: These controllers are combination motor starters with suitable sensing devices for control and operation of booster pump motors. They have motor overload relays to protect the pump motors. They also have fusible disconnects or circuit breakers to provide short circuit protection within the short circuit rating of the controller. Most have one or more pressure switches for controlling system pressure. Standard units incorporate a PLC (programmable logic controller) to control the timing and sequencing of the pump motor or motors. Various options may also be supplied.

INSTALLATION INSTRUCTIONS

Safety Precaution: Before any electrical work is done on the controller, make sure the disconnect switch and the control switch(es) are in the off position.

Mounting: These controllers are normally mounted by the pump manufacture at their factory as part of the booster pump system package. Where the controller is separate from the pumps, the enclosure must be mounted vertically on a rigid surface such as a wall or suitable structural members. Mount the enclosure in an area free from dripping and spraying water and all for adequate access to the front and the side or sides of the controller where pressure switches are installed. Use conduit hubs which are suitable for the rating of the controller. The standard enclosure is rated as NEMA 1. Use NEMA 12 or NEMA 4 hubs for enclosures so rated.

Power Supply: Use branch circuit protection on the incoming line (mains). Check the motor and controller raging label to verify they match the incoming line voltage, frequency and current requirements. The rating label is located on the front side of the controller door.

Wiring: All motor circuit conductors should be sized according to the National Electric Code article 430, part B. Insulation for these conductors should be chosen so it will not be affected by the surrounding environment. The input power wiring is connected to the fusible disconnect or main circuit breaker incoming lugs. The output motor wiring is connected to the motor starter(s) overload relay terminals. Protect internal components from drilling chips and debris. On duplex, triplex, & etc. systems where one pump is smaller than the other(s) wire the smaller pump to motor starter number 1.

Plumbing: The pressure sense lines are normally factory installed as part of the pumping package. Where external or other pressure connections are required, use suitable tubing.

Protection: Motor circuit fuses or circuit breakers are furnished according to the National Electric Code (NFPA-70) table 430-148 (Single Phase) and 430-152 (Three Phase) which is based on the full load motor current. If not specified, the full load current is taken from a standard motor current table for Design "B", 1.15 service factor, 40% rise, 60 Hz (50 HZ for 380 Vac or 220 Vac Controllers), A.C. Squirrel Cage Induction 2 Pole or 4 Pole motors. The table is applied to the voltage and horsepower applicable.

The Overload Relay is furnished and set according to the motor Service Factor Amps which is based on the full load motor current times its maximum Service Factor.

M-PLEX Series -- Booster Pump Motor Controller

Installation instructions - cont'd

Start-up: After the mounting, wiring, and plumbing are completed, and the system is ready to be pressurized, the following should be performed:

1. Close and latch the door (Operation of the disconnect switch is interlocked with the door).
2. Set the disconnect switch to the "on" position.
3. For each pump, momentarily turn the HOA (Hand-Off-Auto) selector switch to "MAN" (Manual) position while watching the direction of the motor rotation. If correction is necessary, open (turn off) the disconnect switch and interchange two of the motor leads. Repeat the last two steps.

CAUTION: *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.*

4. Adjust the pressure switch or switches to the desired turn-on and turn-off settings. Standard systems have a system pressure switch (PS-2) and a low suction pressure cut-off switch (PS-1). Adjust others as needed. Optional pressure switches may include a tank pressure switch and various alarm switches. Some units may also have one or more level switches. Detailed set-up instructions for the pressure switches and PLC timers follows after the Sequence of Operation section.
5. Turn the selector switch to the "Auto" position to put the pump in service.

APPLICATION

Standard (Typical) Systems: These controllers are used to control one or more pump motors. On multiple pump installations, the pumps may be equal in size (horsepower) or may be different sizes. The most common systems are duplex systems with one small and one larger pump and triplex systems with one small and two larger motors, where the larger motors are typically of the same size. In standard units where one pump is smaller than the other(s) it is meant to run continuously. If it is in a duplex system, the pumps won't be alternated from Lead to Lag. Alternation schemes:

Equal Size Pumps: Yes for Duplex (both), Triplex (all three), and Quadraplex (all four).
Unequal Size Pumps: No for Duplex, Yes for Triplex (Pumps #2 and #3) and Quadraplex (Pumps #2, #3 and #4). Pump #1 (the smaller pump) runs continuously.

Pressure Regulated Systems: Standard systems utilize a pressure regulating valve (PRV) for each pump. The pump motor controller responds to the system pressure to start and stop (control) the pump or pumps. When the system pressure drops below a preset amount, usually just below the PRV setting(s), the controller causes the next pump to start. When the pressure rises sufficiently, the controller stops the last pump started, usually after a minimum running interval. A low pressure alarm and shutdown is included in standard systems to protect the pump(s) form running dry or cavitating on absent or low inlet pressure.

M-PLEX Series -- Booster Pump Motor Controller

Optional Systems

Pressure Transducer Systems: The controller uses a solid state pressure transducer to control the operation (starting and stopping) of the motor(s). This takes the place of the System Pressure Switch. The transducer signal is connected to the PLC which has programmable start and stop set points. When the system pressure drops below the preset pressure, usually just below the PRV setting(s), the controller causes the next pump to start. Rising pressure causes the controller to cycle the pump(s) off.

Pressure Tank systems: The booster pump system (package) may include an optional pressure tank to improve system performance. In this case the controller responds to pressure in the tank to maintain the tank pressure at a level above the system pressure in order to provide adequate pressure to the pressure regulating valve or valves. When the pressure rises sufficiently, the controller stops the last pump started, normally after a minimum running interval.

Flow Based Systems: One or more flow meters or flow switches are used as input signals to the controller in place of the system pressure switch or transducer. When the flow in a pump is near its rated (maximum) flow, the controller starts another pump to supply the system demand (flow). When the flow drops below a set amount, usually below 50%, the controller stops the respective pump, usually after the minimum running interval has elapsed.

Pump Motor Current Based Systems: One or more motor Current Sensors are used as input signals to the controller in place of the system pressure switch or transducer. When the motor current of pump motor is near its rated Full Load Current (Full Load Amperes) or near its rated service factor current, the controller starts another pump to supply the system demand (flow). When the current drops below a set amount, usually below 50%, the controller stops the respective pump, usually after the minimum running interval has elapsed.

SEQUENCE OF OPERATION

General: These units control one or more booster pump motors to maintain the pressure in a system within a selected range. This is accomplished with a pressure switch which has a fixed differential (4lbs @ 100psi). Refer to the wiring or schematic diagram for details. Standard units have one or more motor starters, a Control Power Transformer (CPT) and secondary and dual primary fuses for same. Standard units include a PLC for logic sequencing, timing and control. Standard units also include an audible alarm, which can be silenced, and one or more visual alarm lights. The standard unit also includes one or more Pump Running signal lights, L2 & etc.

Power Wiring: The input lines (mains) connect to the top of the Disconnect Switch (DS) or Circuit Breaker CB. Power flows through the short circuit protection motor Line (Mains) Fuses 1F & etc., or Circuit Breaker CB, and then to the Motor Starter, which is horsepower rated. The Motor Starter consists of Motor Contactor (1M & etc.) and Overload Relay OL-1 & etc.. When the Motor Contactor Coil 1M, or etc., is energized, Motor Contactor 1M contacts close to feed power through the Overload Relay to its output terminals where the motor is connected. This energizes the motor to start the pump.

M-PLEX Series -- Booster Pump Motor Controller

Sequence of Operation - Continued

Control Transformer: Control power is supplied by a Control Power Transformer (CPT). Its primary is supplied by two primary side line fuses. The secondary output of the transformer is protected by a secondary fuse. See the controller Schematic Diagram for the fuse designations. Secondary control power is 115 Vac (110 - 120 Vac) at 50 or 60 Hz depending on the line (mains) frequency. Secondary power is used for the motor contactor coils, indicator (pilot) lights, audible alarm, the PLC and any additional control relays or components.

Overload Relay: The Overload Relay furnished in the motor starter provide protection from excessive currents. The overload relay has been sized and set to trip open when the motor exceeds 125% of the Full Load Current (FLA) multiplied by the rated Service Factor (SF). Trip times vary depending on the magnitude of the current overload, the number of previous starts, the ambient temperature of the controller, and the size of the overload element. Briefly, the Overload Relay is sized to allow initial starting currents while protecting the motor from excessive long starting currents or excessive running currents. (See Installation Instructions - Protection for proper sizing).

Power Available Light: A Power Available pilot light (L1) indicates then the disconnect switch (DS) or main circuit breaker is closed, and when power is supplied to the unit and when the CPT primary and secondary fuses are not blown.

Control Selector Switch: One selector switch, HOA-1 & etc., is included for each motor. The switch includes a "MAN" (Manual, Hand) position, an "OFF"(Safety) position, and an "AUTO" (Automatic Control) position. In the manual position, the Pressure Switch and all automatic control is bypassed so the contactor coil is continuously energized by the selector switch. The Overload Relay contacts also override the manual position to protect the motor. *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.*

"OFF" (Safety) Position: In the "OFF" position, the Motor Contactor coil is de-energized to prevent the motor from running.

"MAN" Position (Manual Control): Control power wiring is tapped off the incoming power on the load (down-stream) side of the Line Fuses or Circuit Breaker. It is routed to the three position (Auto-Off-Manual) selector switch. In the manual position, the all pressure switches and all automatic control is bypassed so the contactor coil is continuously energized by the selector switch. The Overload Relay contacts also override the manual position to protect the motor. *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.* The Minimum Run Timer does not operate with the selector switch in the MANUAL position.

"AUTO" (Automatic Control) Position: In this position, the motor starter is connected to the appropriate output terminal of the PLC (Programmable Logic Controller) which enables automatic control of the pump motor by the PLC. Note that overload relay operation is independent of the PLC or any other control circuitry to protect the motor.

Motor Running Light(s): The Pump 1 Running light activates when ever the motor contactor (starter) for Motor No. 1 is closed under either manual or automatic control.

M-PLEX Series -- Booster Pump Motor Controller

Automatic (PLC) Control

Alarm Circuit: The standard unit includes alarm circuitry to annunciate failure or fault conditions. The standard alarm condition is Low Suction Pressure as sensed by the Low Suction Pressure switch (PS-1). When the pressure drops to less than the trip setting of this pressure switch, it's contacts close. This signals the PLC that the condition has occurred. The PLC activates the Low Suction Audible Alarm. The standard audible device is a solid state (Sonalert) annunciator. The PLC also activates a Low Suction alarm signal light. The alarm can be silenced by momentarily operating the Alarm Silence switch (SW-1) which signals the PLC to de-activate the audible alarm. The alarm light stays lit until the Low Suction Pressure switch resets. The alarm circuit resets itself and re-activates on the next occurrence of low suction pressure.

General: In the AUTO position, motor operation is under the control of the PLC. The PLC utilizes an internally stored program to control the operation (starting and stopping) of the motor. The PLC responds to the Low Suction Pressure switch and to System Pressure Switch as a minimum. The PLC program also includes various timing functions as outlined below.

Pressure Sensing: The standard unit is pressure controlled by sensing either the system pressure or by sensing the pressure in a tank, if supplied. Multiple pump systems (Duplex & etc.) may employ equal size pumps or one pump may be smaller than the others.

Alternation: The standard system employs one smaller pump and one or more later pumps. If there is more than one larger pump (Triplex or Quadraplex) they are usually equal in size to one another. The small pump is meant to run continuously. The controller cycles the larger pump or pumps as needed to maintain system pressure. Alternation of the pumps in not used in Duplex systems of this type. The smaller pump which runs continuously is considered the "Lead" pump and the other pump or pumps are considered the "Lag" pump or pumps.

When all pumps are of the same size, a duplex controller may be set up to alternate which of the two, or more) pumps operates as the Lead pump and which pump or pumps operates as the Lag pump or pumps.

Minimum Run Timing: The standard unit includes timers to control the Minimum Running time of the pump or pumps to prevent short cycling of the pump motor(s). This avoids overheating the motors which can occur if they are started to frequently. This allows the motor fan to cool down the motor windings from the last start before the pump is shut down.

Restart Delay Timing: The Restart delay prevents starting a pump which is still spinning down from the last running. This can occur when the demand is less than needed for the pump but more than what can be supplied by the other pump(s). In this case, when the pump shuts down, the pressure can drop rapidly enough to immediately signal the pump to start again. If the pump is still spinning, this can cause mechanical shock to the pump and motor and can also cause large spikes (momentarily large transient) currents which can blow fuses or trip circuit breakers. This occurs when the motor magnetic flux vector angle is out of phase with the power line phase angle by large enough difference. The Restart delay lets the motor come to rest or near rest which also allows the motor magnetic flux to decay. In this state, the motor can be safely restarted with out excessive transients and mechanical shock.

M-PLEX Series -- Booster Pump Motor Controller

Automatic (PLC) Control - cont'd

Alternation Times: Note: The Alternation Times apply only to controllers for two or more motors (Duplex & etc.). The Alternation Time is the clock time that must elapse before the PLC changes the pump from being a Leading pump into a Lagging pump. The Alternation Times are independent of the motor actual running time.

Alternator Overlap Time: When one or more pumps are not running, alternating the pumps can cause a momentary pressure drop when the running pump spins down before the other pump comes up to full speed. The overlap timer is an over run timer that causes a delay before the pump is shut down. This allows the second pump to come up to full speed while the first pump continues to run. After a typical setting of a few seconds, the controller shuts down the first pump if it is not needed for the system demand.

Controller Set-up and Adjustments

Preliminary Steps: Before attempting to adjust the pressure switch in pressure controlled systems, adjust the pump pressure regulating valves for the desired system pressure(s). Remove the covers from the pressure switch(s). A system pressure gauge is required for setting the System Pressure Switch.

Warning - Shock Hazard: *Some settings require observing or adjusting PLC settings and LED indicators. Use Caution to avoid contact with any electrical terminals, fuses, or connections to avoid electrical shock.*

Low Pressure (Cut-Off) Pressure Switch: Set the pressure switch to the desired cut-off pressure as indicated on the indicator dial. One example of a setting for a booster pump drawing suction from a municipal main would be 20 to 30 psi for the trip point of this switch.

Pressure Switch Set-up: To set the System Pressure switch (PS-2) remove its cover. Start the (lead) pump manually ("MAN" position) and modulate the system flow until the pressure drops just below the desired set point. Adjust the pressure switch On (Start) adjustment until the Input I-0 LED on the PLC lights. Set the pressure switch Off (Stop) setting as close as practical to the On setting. Typical settings on a 100 PSI nominal system would be trip (start) at 98 psi and reset at 102 psi. Verify the settings by modulating the system flow and observe when the PLC Input I-0 LED actuates and extinguishes.

Level (Float Switch) Controlled: Set the level switches to the desired ON-OFF settings. See Schematic Diagram(s) or PLC Ladder Diagrams for PLC inputs. The input LED's I* on the PLC will illuminate when level switch is closed.

Timer (TIM) Settings: Note: Changing the timers requires one of three procedures. 1) The times are set at the factory using a lap-top computer with the appropriate program and communications cable, or 2) an optional memory chip can be programmed at the factory for the new times and added to the PLC in question, or 3) an HMI display and setting module can be installed onto the PLC for the purpose of changing the timer settings. Contact the factory for details on how this module is used. All timer settings are in seconds. (See Schematic Diagram or PLC Ladder Diagram for Timer information)

M-PLEX Series -- Booster Pump Motor Controller

Controller Set-up and Adjustments - cont'd

Set-up Checklist

I. ENERGIZING CONTROLLER

___A. Close and Latch the controller door.

___B. With the controller door closed, close the Main Disconnect (DS).

___C. Check that the Power On indicating lamp is lit.

___D. Pump Rotation Check: Check for motor rotation by jogging (bumping) the motor(s). Do this by placing Pump 1 HOA switch in the Hand (Manual) position and then back to the OFF position. Check the rotation of Pump 1. If the pump runs backwards, open the Main Disconnect (DS) and controller door, and reverse two of the three motor leads at the contactor output to change rotation. Repeat this for all other pumps. Re-close the door and Main Disconnect.

II ADJUSTING THE HYDROPNEUMATIC TANK REGULATING VALVE

(If Tank is present)

CAUTION - Tank must be charged with air at the same PSI as required System pressure. Water must flow to adjust the pressure regulating valve. [Open faucet(s) at the discharge]

___A. Verify Tank has been charged with air at the same PSI as the required System Pressure.

___B. Close all pump isolation valves on the PRV's except the valves feeding the Tank.

___C. Place any pump HOA switch in Hand (Manual). The corresponding pump will run. While pump is running, monitor the discharge pressure gauge. Adjust the setscrew on the pressure-regulating valve on the discharge of the tank so the gauge reads the required system pressure. Use lock nut on the setscrew to lock-in the valve setting.

III. ADJUSTING THE PRESSURE REDUCING VALVES (PRV'S)

CAUTION - If hydropneumatic tank is present, it must be charged with air at the same PSI as System pressure before continuing. Water must flow to adjust PRV's. [Open faucet(s) at the discharge]

___A. Close all pump isolation valves except for the valves in-line with the PRV being adjusted.

___B. Place the corresponding HOA switch in Hand (Manual). The pump will run.

___C. While pump is running, monitor the discharge pressure gauge; adjust the setscrew at the regulator on the PRV so the pressure gauge reads the required System Pressure. Use the lock nut on the setscrew to lock-in the PRV setting. Place the HOA switch in the off position to shut down pump. Repeat steps A, B & C for the other PRV's.

M-PLEX Series -- Booster Pump Motor Controller

Set-up Checklist cont'd

IV ADJUSTING THE LOW SUCTION PRESSURE SWITCH (PS-1)

___A. Close all gate valves.
___B. Remove cover from pressure switch PS-1.
___C. Open controller door and close main disconnect.
___D. Locate input LED # 1 on the PLC. This is the input to the PLC from the PS-1. LED must be on to enable controller.
___E. Viewing adjusting dial on PS-1 from top, rotate counterclockwise until the LED # 1 turns on and the top of the dial is lined up with zero on the scale. The suction pressure switch is now set at 5-10 PSI.

V ADJUSTING THE SYSTEM PRESSURE SWITCH (PS-2)

CAUTION - PRV's and Tank (if present) must be adjusted. Water must flow to adjust the pressure switches. [Open faucet(s) at the discharge]

___A. Open all valves.
___B. Remove cover from pressure switch PS-2.
___C. Open controller door and close main disconnect.
___D. Place any pump HOA switch in Hand (Manual) position. The corresponding pump will run. While pump is running, monitor the discharge pressure gauge. Verify gauge reads system pressure.
___E. Locate input LED # 0 on the PLC. This is the input to the PLC from the PS-2. LED turns on when Lag Pump(s) runs.
___F. Viewing adjusting dial on PS-2 from top, rotate clockwise to turn LED # 0 off and counterclockwise to turn LED on. To set the switch, rotate dial so LED turns off, then turn it an additional 1/4 turn. The system pressure switch is now set to turn lag(s) pump(s) on when system pressure drops.

VI ADJUSTING THE TANK PRESSURE SWITCH (PS-4)

CAUTION - PRV's and Tank (if present) must be adjusted. Water must flow to adjust the pressure switches. [Open faucet(s) at the discharge]

NOTE - If Hydrophenmatic tank is not present, lead pump runs continuously to maintain system pressure.

___A. Close all pump discharge valves.
___B. Remove cover from pressure switch PS-4.
___C. Open controller door and close main disconnect.
___D. Place any pump HOA switch in Hand (Manual) position. The corresponding pump will run. While pump is running, monitor the **TANK** pressure gauge. Verify gauge reads 3 PSI above system pressure. Turn pump off if pressure is high. Close discharge faucet(s) once pressure reading is correct.
___E. Locate input LED # 3 on the PLC. This is the input to the PLC from the PS-4. LED turns on when Lead Pump runs.
___F. Viewing adjusting dial on PS-4 from top, rotate **Bottom** dial counterclockwise until dial stops. Then turn **Top** dial clockwise slowly until LED # 3 turns on. Tank pressure switch is now set.

Service and Assistance: Contact either the pump manufacture field agent or the Master Control Systems field agent for assistance. The factory can be contacted at the address and numbers shown on the next page.

MODEL SPX, DPX & etc.

M-PLEX Series -- Booster Pump Motor Controller

REPLACEMENT PARTS LIST

Symbol	Part No.	Description	Notes
DS	302400	Disconnect Switch, 600 Vac, 30/40 Amp (Internal Switch only)	
DS	302401	Disconnect Switch, 600 Vac, 60/80 Amp (Internal Switch only)	
DS	302402	Disconnect Switch, 600 Vac, 100 Amp (Internal Switch only)	
---	400939	Disconnect Switch Handle Operator only, (30 thru 100 Amp)	
HOA	401199	Auto-Off-Manual Selector Switch	
---	401992	Contact Block (N.O.)	
PS*	305420	Standard Pressure Switch	
PS4	305421	Tank Pressure Switch	
PLC	305580	Programmable Logic Controller (standard units only)	
---	305040	Control Power Transformer, 50 VA, 208/240/460 Vac	
---	305041	Control Power Transformer, 50 VA, 208/380/575 Vac	

Note: One or more renewal parts such as fuses, heaters, contacts, and etc. may be obtained from local electrical distributor(s).

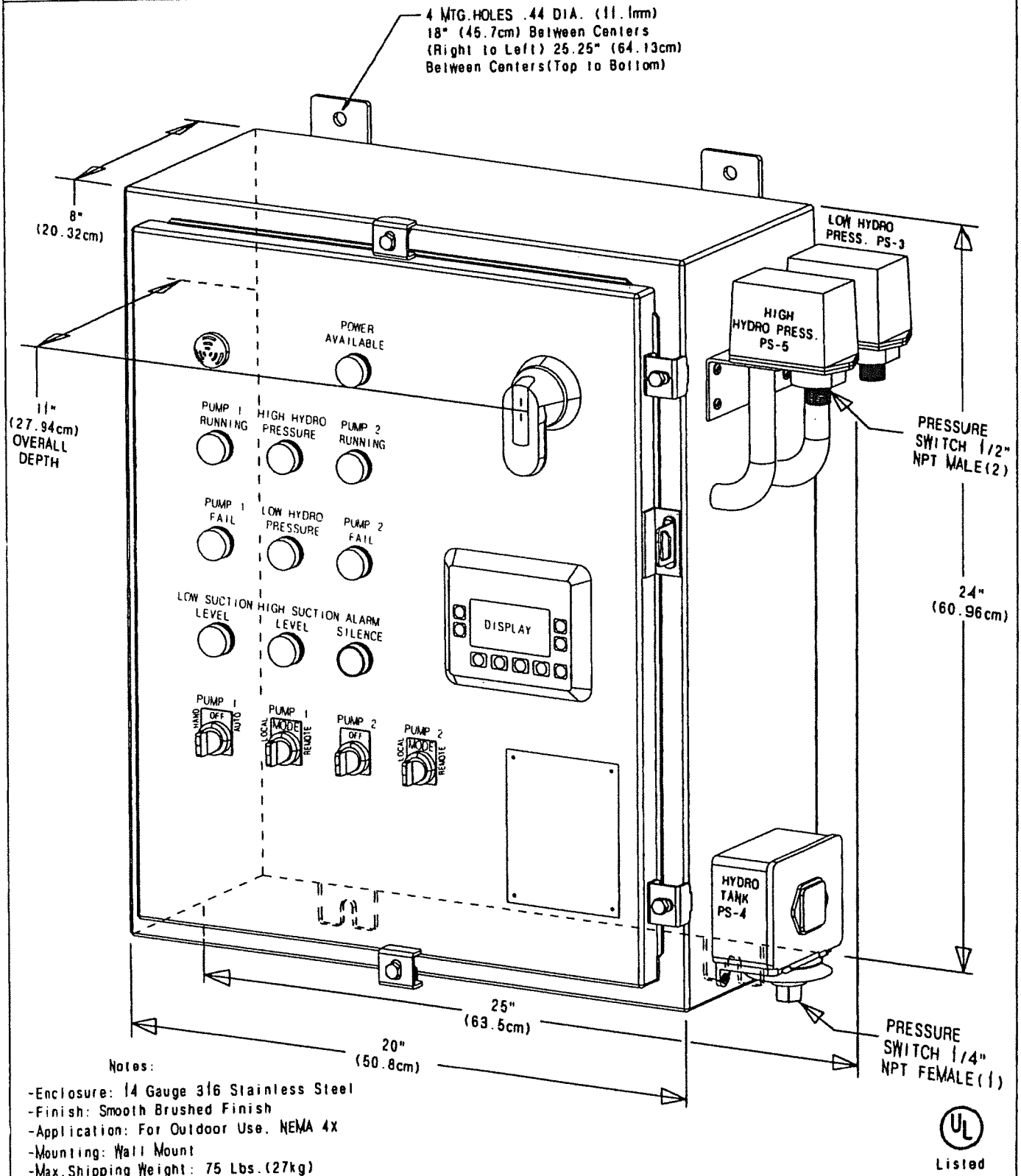
IMPORTANT: When ordering replacement parts, be sure to specify the complete MODEL NUMBER and SERIAL NUMBER of controller in which they are to be used.

MASTER CONTROL SYSTEMS, INC.
910 North Shore Drive
Lake Bluff, IL 60044 USA

Phone: 847-295-1010 Fax: 847-295-0704
E-Mail: sales@mastercontrols.com
Web Page: http://www.mastercontrols.com

DPXA Constant Pressure Booster Duplex Controller

MASTER



Notes:

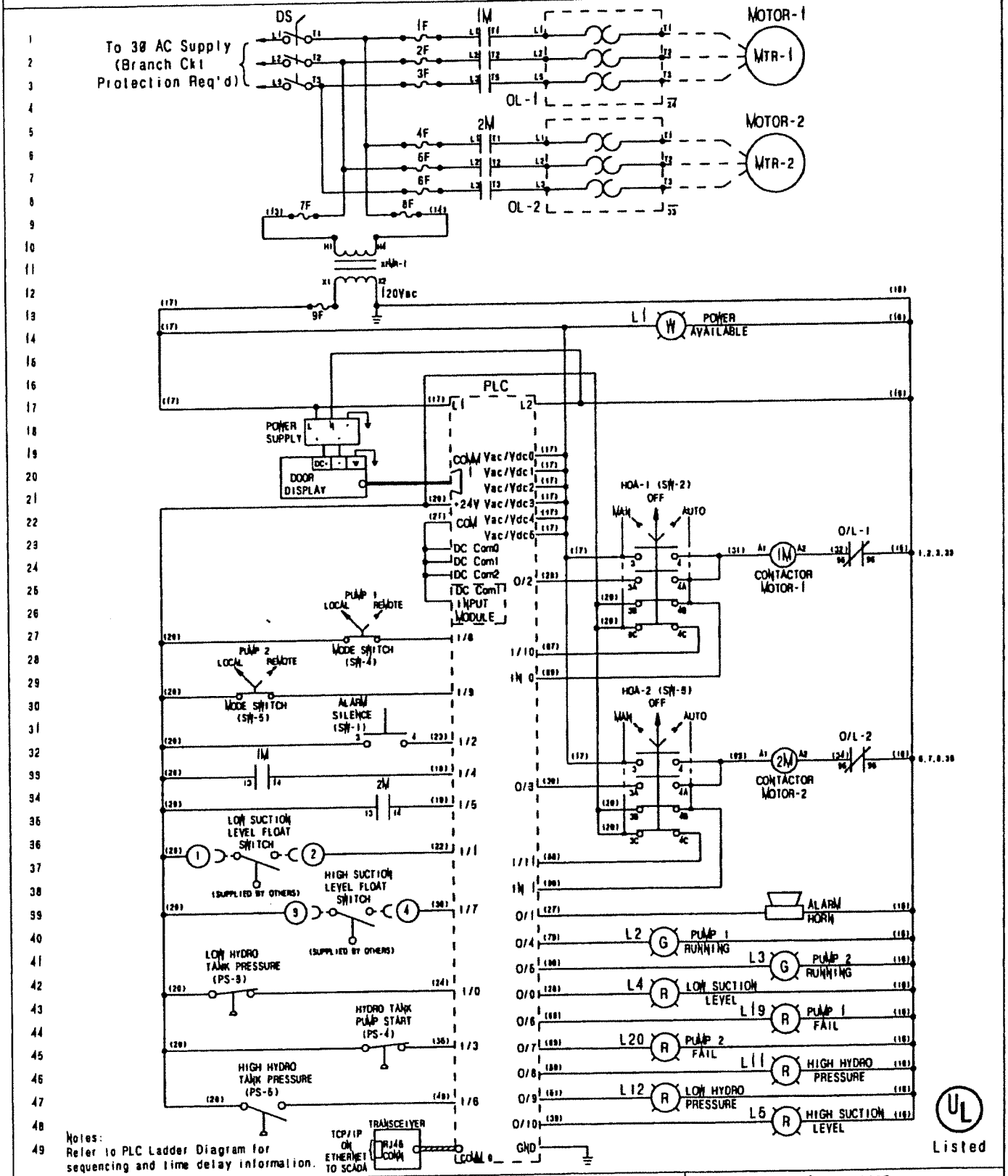
- Enclosure: 14 Gauge 316 Stainless Steel
- Finish: Smooth Brushed Finish
- Application: For Outdoor Use. NEMA 4X
- Mounting: Wall Mount
- Max. Shipping Weight: 75 Lbs.(27kg)

UL Listed

Master Control Systems Inc. LAKE BLUFF, ILLINOIS U.S.A.	Constant Pressure Booster Duplex Controller Dimensional	Date	8 August 2006
		Drawing	11807 Issue 7

DPXA Constant Pressure Booster Duplex Controller

MASTER



Notes:
Refer to PLC Ladder Diagram for sequencing and time delay information.

UL Listed

Master Control Systems Inc. LAKE BLUFF, ILLINOIS U.S.A.	Constant Pressure Booster Duplex Controller Schematic	Date	8 August 2005
		Drawing	11818 Issue 10

APPENDIX J – ATTENUATION BASIN PUMP BUILDING SEAL WATER SKID EXISTING CONTROL PANEL INFORMATION

Addendum No. 2 - File No. 121-24

INSTRUCTION MANUAL

Master Control Systems, Inc. "M-PLEX" Series

Pump Motor Controllers

-- for --

Models SPX, DPX, TPX & QPX

Simplex, Duplex, Triplex and Quadraplex

Table of Contents

Addendum No. 2 - File No. 121-24

M-PLEX Series -of- Booster Pump Motor Controller

General: These controllers are combination motor starters with suitable sensing devices for control and operation of booster pump motors. They have motor overload relays to protect the pump motors. They also have fusible disconnects or circuit breakers to provide short circuit protection within the short circuit rating of the controller. Most have one or more pressure switches for controlling system pressure. Standard units incorporate a PLC (programmable logic controller) to control the timing and sequencing of the pump motor or motors. Various options may also be supplied.

INSTALLATION INSTRUCTIONS

Safety Precaution: Before any electrical work is done on the controller, make sure the disconnect switch and the control switch(es) are in the off position.

Mounting: These controllers are normally mounted by the pump manufacture at their factory as part of the booster pump system package. Where the controller is separate from the pumps, the enclosure must be mounted vertically on a rigid surface such as a wall or suitable structural members. Mount the enclosure in an area free from dripping and spraying water and all for adequate access to the front and the side or sides of the controller where pressure switches are installed. Use conduit hubs which are suitable for the rating of the controller. The standard enclosure is rated as NEMA 1. Use NEMA 12 or NEMA 4 hubs for enclosures so rated.

Power Supply: Use branch circuit protection on the incoming line (mains). Check the motor and controller raging label to verify they match the incoming line voltage, frequency and current requirements. The rating label is located on the front side of the controller door.

Wiring: All motor circuit conductors should be sized according to the National Electric Code article 430, part B. Insulation for these conductors should be chosen so it will not be affected by the surrounding environment. The input power wiring is connected to the fusible disconnect or main circuit breaker incoming lugs. The output motor wiring is connected to the motor starter(s) overload relay terminals. Protect internal components from drilling chips and debris. On duplex, triplex, & etc. systems where one pump is smaller than the other(s) wire the smaller pump to motor starter number 1.

Plumbing: The pressure sense lines are normally factory installed as part of the pumping package. Where external or other pressure connections are required, use suitable tubing.

Protection: Motor circuit fuses or circuit breakers are furnished according to the National Electric Code (NFPA-70) table 430-148 (Single Phase) and 430-152 (Three Phase) which is based on the full load motor current. If not specified, the full load current is taken from a standard motor current table for Design "B", 1.15 service factor, 40% rise, 60 Hz (50 HZ for 380 Vac or 220 Vac Controllers), A.C. Squirrel Cage Induction 2 Pole or 4 Pole motors. The table is applied to the voltage and horsepower applicable.

The Overload Relay is furnished and set according to the motor Service Factor Amps which is based on the full load motor current times its maximum Service Factor.

M-PLEX Series -- Booster Pump Motor Controller

Installation instructions - cont'd

Start-up: After the mounting, wiring, and plumbing are completed, and the system is ready to be pressurized, the following should be performed:

1. Close and latch the door (Operation of the disconnect switch is interlocked with the door).
2. Set the disconnect switch to the "on" position.
3. For each pump, momentarily turn the HOA (Hand-Off-Auto) selector switch to "MAN" (Manual) position while watching the direction of the motor rotation. If correction is necessary, open (turn off) the disconnect switch and interchange two of the motor leads. Repeat the last two steps.

CAUTION: *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.*

4. Adjust the pressure switch or switches to the desired turn-on and turn-off settings. Standard systems have a system pressure switch (PS-2) and a low suction pressure cut-off switch (PS-1). Adjust others as needed. Optional pressure switches may include a tank pressure switch and various alarm switches. Some units may also have one or more level switches. Detailed set-up instructions for the pressure switches and PLC timers follows after the Sequence of Operation section.
5. Turn the selector switch to the "Auto" position to put the pump in service.

APPLICATION

Standard (Typical) Systems: These controllers are used to control one or more pump motors. On multiple pump installations, the pumps may be equal in size (horsepower) or may be different sizes. The most common systems are duplex systems with one small and one larger pump and triplex systems with one small and two larger motors, where the larger motors are typically of the same size. In standard units where one pump is smaller than the other(s) it is meant to run continuously. If it is in a duplex system, the pumps won't be alternated from Lead to Lag. Alternation schemes:

Equal Size Pumps: Yes for Duplex (both), Triplex (all three), and Quadraplex (all four).
Unequal Size Pumps: No for Duplex, Yes for Triplex (Pumps #2 and #3) and Quadraplex (Pumps #2, #3 and #4). Pump #1 (the smaller pump) runs continuously.

Pressure Regulated Systems: Standard systems utilize a pressure regulating valve (PRV) for each pump. The pump motor controller responds to the system pressure to start and stop (control) the pump or pumps. When the system pressure drops below a preset amount, usually just below the PRV setting(s), the controller causes the next pump to start. When the pressure rises sufficiently, the controller stops the last pump started, usually after a minimum running interval. A low pressure alarm and shutdown is included in standard systems to protect the pump(s) form running dry or cavitating on absent or low inlet pressure.

M-PLEX Series -- Booster Pump Motor Controller

Optional Systems

Pressure Transducer Systems: The controller uses a solid state pressure transducer to control the operation (starting and stopping) of the motor(s). This takes the place of the System Pressure Switch. The transducer signal is connected to the PLC which has programmable start and stop set points. When the system pressure drops below the preset pressure, usually just below the PRV setting(s), the controller causes the next pump to start. Rising pressure causes the controller to cycle the pump(s) off.

Pressure Tank systems: The booster pump system (package) may include an optional pressure tank to improve system performance. In this case the controller responds to pressure in the tank to maintain the tank pressure at a level above the system pressure in order to provide adequate pressure to the pressure regulating valve or valves. When the pressure rises sufficiently, the controller stops the last pump started, normally after a minimum running interval.

Flow Based Systems: One or more flow meters or flow switches are used as input signals to the controller in place of the system pressure switch or transducer. When the flow in a pump is near its rated (maximum) flow, the controller starts another pump to supply the system demand (flow). When the flow drops below a set amount, usually below 50%, the controller stops the respective pump, usually after the minimum running interval has elapsed.

Pump Motor Current Based Systems: One or more motor Current Sensors are used as input signals to the controller in place of the system pressure switch or transducer. When the motor current of pump motor is near its rated Full Load Current (Full Load Amperes) or near its rated service factor current, the controller starts another pump to supply the system demand (flow). When the current drops below a set amount, usually below 50%, the controller stops the respective pump, usually after the minimum running interval has elapsed.

SEQUENCE OF OPERATION

General: These units control one or more booster pump motors to maintain the pressure in a system within a selected range. This is accomplished with a pressure switch which has a fixed differential (4lbs @ 100psi). Refer to the wiring or schematic diagram for details. Standard units have one or more motor starters, a Control Power Transformer (CPT) and secondary and dual primary fuses for same. Standard units include a PLC for logic sequencing, timing and control. Standard units also include an audible alarm, which can be silenced, and one or more visual alarm lights. The standard unit also includes one or more Pump Running signal lights, L2 & etc.

Power Wiring: The input lines (mains) connect to the top of the Disconnect Switch (DS) or Circuit Breaker CB. Power flows through the short circuit protection motor Line (Mains) Fuses 1F & etc., or Circuit Breaker CB, and then to the Motor Starter, which is horsepower rated. The Motor Starter consists of Motor Contactor (1M & etc.) and Overload Relay OL-1 & etc.. When the Motor Contactor Coil 1M, or etc., is energized, Motor Contactor 1M contacts close to feed power through the Overload Relay to its output terminals where the motor is connected. This energizes the motor to start the pump.

M-PLEX Series -- Booster Pump Motor Controller

Sequence of Operation - Continued

Control Transformer: Control power is supplied by a Control Power Transformer (CPT). Its primary is supplied by two primary side line fuses. The secondary output of the transformer is protected by a secondary fuse. See the controller Schematic Diagram for the fuse designations. Secondary control power is 115 Vac (110 - 120 Vac) at 50 or 60 Hz depending on the line (mains) frequency. Secondary power is used for the motor contactor coils, indicator (pilot) lights, audible alarm, the PLC and any additional control relays or components.

Overload Relay: The Overload Relay furnished in the motor starter provide protection from excessive currents. The overload relay has been sized and set to trip open when the motor exceeds 125% of the Full Load Current (FLA) multiplied by the rated Service Factor (SF). Trip times vary depending on the magnitude of the current overload, the number of previous starts, the ambient temperature of the controller, and the size of the overload element. Briefly, the Overload Relay is sized to allow initial starting currents while protecting the motor from excessive long starting currents or excessive running currents. (See Installation Instructions - Protection for proper sizing).

Power Available Light: A Power Available pilot light (L1) indicates then the disconnect switch (DS) or main circuit breaker is closed, and when power is supplied to the unit and when the CPT primary and secondary fuses are not blown.

Control Selector Switch: One selector switch, HOA-1 & etc., is included for each motor. The switch includes a "MAN" (Manual, Hand) position, an "OFF"(Safety) position, and an "AUTO" (Automatic Control) position. In the manual position, the Pressure Switch and all automatic control is bypassed so the contactor coil is continuously energized by the selector switch. The Overload Relay contacts also override the manual position to protect the motor. *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.*

"OFF" (Safety) Position: In the "OFF" position, the Motor Contactor coil is de-energized to prevent the motor from running.

"MAN" Position (Manual Control): Control power wiring is tapped off the incoming power on the load (down-stream) side of the Line Fuses or Circuit Breaker. It is routed to the three position (Auto-Off-Manual) selector switch. In the manual position, the all pressure switches and all automatic control is bypassed so the contactor coil is continuously energized by the selector switch. The Overload Relay contacts also override the manual position to protect the motor. *Use care when using the MANUAL (MAN) position of the control switch to avoid causing system Over Pressure.* The Minimum Run Timer does not operate with the selector switch in the MANUAL position.

"AUTO" (Automatic Control) Position: In this position, the motor starter is connected to the appropriate output terminal of the PLC (Programmable Logic Controller) which enables automatic control of the pump motor by the PLC. Note that overload relay operation is independent of the PLC or any other control circuitry to protect the motor.

Motor Running Light(s): The Pump 1 Running light activates when ever the motor contactor (starter) for Motor No. 1 is closed under either manual or automatic control.

M-PLEX Series -- Booster Pump Motor Controller

Automatic (PLC) Control

Alarm Circuit: The standard unit includes alarm circuitry to annunciate failure or fault conditions. The standard alarm condition is Low Suction Pressure as sensed by the Low Suction Pressure switch (PS-1). When the pressure drops to less than the trip setting of this pressure switch, it's contacts close. This signals the PLC that the condition has occurred. The PLC activates the Low Suction Audible Alarm. The standard audible device is a solid state (Sonalert) annunciator. The PLC also activates a Low Suction alarm signal light. The alarm can be silenced by momentarily operating the Alarm Silence switch (SW-1) which signals the PLC to de-activate the audible alarm. The alarm light stays lit until the Low Suction Pressure switch resets. The alarm circuit resets itself and re-activates on the next occurrence of low suction pressure.

General: In the AUTO position, motor operation is under the control of the PLC. The PLC utilizes an internally stored program to control the operation (starting and stopping) of the motor. The PLC responds to the Low Suction Pressure switch and to System Pressure Switch as a minimum. The PLC program also includes various timing functions as outlined below.

Pressure Sensing: The standard unit is pressure controlled by sensing either the system pressure or by sensing the pressure in a tank, if supplied. Multiple pump systems (Duplex & etc.) may employ equal size pumps or one pump may be smaller than the others.

Alternation: The standard system employs one smaller pump and one or more later pumps. If there is more than one larger pump (Triplex or Quadraplex) they are usually equal in size to one another. The small pump is meant to run continuously. The controller cycles the larger pump or pumps as needed to maintain system pressure. Alternation of the pumps in not used in Duplex systems of this type. The smaller pump which runs continuously is considered the "Lead" pump and the other pump or pumps are considered the "Lag" pump or pumps.

When all pumps are of the same size, a duplex controller may be set up to alternate which of the two, or more) pumps operates as the Lead pump and which pump or pumps operates as the Lag pump or pumps.

Minimum Run Timing: The standard unit includes timers to control the Minimum Running time of the pump or pumps to prevent short cycling of the pump motor(s). This avoids overheating the motors which can occur if they are started to frequently. This allows the motor fan to cool down the motor windings from the last start before the pump is shut down.

Restart Delay Timing: The Restart delay prevents starting a pump which is still spinning down from the last running. This can occur when the demand is less than needed for the pump but more than what can be supplied by the other pump(s). In this case, when the pump shuts down, the pressure can drop rapidly enough to immediately signal the pump to start again. If the pump is still spinning, this can cause mechanical shock to the pump and motor and can also cause large spikes (momentarily large transient) currents which can blow fuses or trip circuit breakers. This occurs when the motor magnetic flux vector angle is out of phase with the power line phase angle by large enough difference. The Restart delay lets the motor come to rest or near rest which also allows the motor magnetic flux to decay. In this state, the motor can be safely restarted with out excessive transients and mechanical shock.

M-PLEX Series -- Booster Pump Motor Controller

Automatic (PLC) Control - cont'd

Alternation Times: Note: The Alternation Times apply only to controllers for two or more motors (Duplex & etc.). The Alternation Time is the clock time that must elapse before the PLC changes the pump from being a Leading pump into a Lagging pump. The Alternation Times are independent of the motor actual running time.

Alternator Overlap Time: When one or more pumps are not running, alternating the pumps can cause a momentary pressure drop when the running pump spins down before the other pump comes up to full speed. The overlap timer is an over run timer that causes a delay before the pump is shut down. This allows the second pump to come up to full speed while the first pump continues to run. After a typical setting of a few seconds, the controller shuts down the first pump if it is not needed for the system demand.

Controller Set-up and Adjustments

Preliminary Steps: Before attempting to adjust the pressure switch in pressure controlled systems, adjust the pump pressure regulating valves for the desired system pressure(s). Remove the covers from the pressure switch(s). A system pressure gauge is required for setting the System Pressure Switch.

Warning - Shock Hazard: *Some settings require observing or adjusting PLC settings and LED indicators. Use Caution to avoid contact with any electrical terminals, fuses, or connections to avoid electrical shock.*

Low Pressure (Cut-Off) Pressure Switch: Set the pressure switch to the desired cut-off pressure as indicated on the indicator dial. One example of a setting for a booster pump drawing suction from a municipal main would be 20 to 30 psi for the trip point of this switch.

Pressure Switch Set-up: To set the System Pressure switch (PS-2) remove its cover. Start the (lead) pump manually ("MAN" position) and modulate the system flow until the pressure drops just below the desired set point. Adjust the pressure switch On (Start) adjustment until the Input I-0 LED on the PLC lights. Set the pressure switch Off (Stop) setting as close as practical to the On setting. Typical settings on a 100 PSI nominal system would be trip (start) at 98 psi and reset at 102 psi. Verify the settings by modulating the system flow and observe when the PLC Input I-0 LED actuates and extinguishes.

Level (Float Switch) Controlled: Set the level switches to the desired ON-OFF settings. See Schematic Diagram(s) or PLC Ladder Diagrams for PLC inputs. The input LED's I* on the PLC will illuminate when level switch is closed.

Timer (TIM) Settings: Note: Changing the timers requires one of three procedures. 1) The times are set at the factory using a lap-top computer with the appropriate program and communications cable, or 2) an optional memory chip can be programmed at the factory for the new times and added to the PLC in question, or 3) an HMI display and setting module can be installed onto the PLC for the purpose of changing the timer settings. Contact the factory for details on how this module is used. All timer settings are in seconds. (See Schematic Diagram or PLC Ladder Diagram for Timer information)

M-PLEX Series -- Booster Pump Motor Controller

Controller Set-up and Adjustments - cont'd

Set-up Checklist

I. ENERGIZING CONTROLLER

___A. Close and Latch the controller door.

___B. With the controller door closed, close the Main Disconnect (DS).

___C. Check that the Power On indicating lamp is lit.

___D. Pump Rotation Check: Check for motor rotation by jogging (bumping) the motor(s). Do this by placing Pump 1 HOA switch in the Hand (Manual) position and then back to the OFF position. Check the rotation of Pump 1. If the pump runs backwards, open the Main Disconnect (DS) and controller door, and reverse two of the three motor leads at the contactor output to change rotation. Repeat this for all other pumps. Re-close the door and Main Disconnect.

II ADJUSTING THE HYDROPNEUMATIC TANK REGULATING VALVE

(If Tank is present)

CAUTION - Tank must be charged with air at the same PSI as required System pressure. Water must flow to adjust the pressure regulating valve. [Open faucet(s) at the discharge]

___A. Verify Tank has been charged with air at the same PSI as the required System Pressure.

___B. Close all pump isolation valves on the PRV's except the valves feeding the Tank.

___C. Place any pump HOA switch in Hand (Manual). The corresponding pump will run. While pump is running, monitor the discharge pressure gauge. Adjust the setscrew on the pressure-regulating valve on the discharge of the tank so the gauge reads the required system pressure. Use lock nut on the setscrew to lock-in the valve setting.

III. ADJUSTING THE PRESSURE REDUCING VALVES (PRV'S)

CAUTION - If hydropneumatic tank is present, it must be charged with air at the same PSI as System pressure before continuing. Water must flow to adjust PRV's. [Open faucet(s) at the discharge]

___A. Close all pump isolation valves except for the valves in-line with the PRV being adjusted.

___B. Place the corresponding HOA switch in Hand (Manual). The pump will run.

___C. While pump is running, monitor the discharge pressure gauge; adjust the setscrew at the regulator on the PRV so the pressure gauge reads the required System Pressure. Use the lock nut on the setscrew to lock-in the PRV setting. Place the HOA switch in the off position to shut down pump. Repeat steps A, B & C for the other PRV's.

M-PLEX Series -- Booster Pump Motor Controller

Set-up Checklist cont'd

IV ADJUSTING THE LOW SUCTION PRESSURE SWITCH (PS-1)

___A. Close all gate valves.
___B. Remove cover from pressure switch PS-1.
___C. Open controller door and close main disconnect.
___D. Locate input LED # 1 on the PLC. This is the input to the PLC from the PS-1. LED must be on to enable controller.
___E. Viewing adjusting dial on PS-1 from top, rotate counterclockwise until the LED # 1 turns on and the top of the dial is lined up with zero on the scale. The suction pressure switch is now set at 5-10 PSI.

V ADJUSTING THE SYSTEM PRESSURE SWITCH (PS-2)

CAUTION - PRV's and Tank (if present) must be adjusted. Water must flow to adjust the pressure switches. [Open faucet(s) at the discharge]

___A. Open all valves.
___B. Remove cover from pressure switch PS-2.
___C. Open controller door and close main disconnect.
___D. Place any pump HOA switch in Hand (Manual) position. The corresponding pump will run. While pump is running, monitor the discharge pressure gauge. Verify gauge reads system pressure.
___E. Locate input LED # 0 on the PLC. This is the input to the PLC from the PS-2. LED turns on when Lag Pump(s) runs.
___F. Viewing adjusting dial on PS-2 from top, rotate clockwise to turn LED # 0 off and counterclockwise to turn LED on. To set the switch, rotate dial so LED turns off, then turn it an additional 1/4 turn. The system pressure switch is now set to turn lag(s) pump(s) on when system pressure drops.

VI ADJUSTING THE TANK PRESSURE SWITCH (PS-4)

CAUTION - PRV's and Tank (if present) must be adjusted. Water must flow to adjust the pressure switches. [Open faucet(s) at the discharge]

NOTE - If Hydrophenmatic tank is not present, lead pump runs continuously to maintain system pressure.

___A. Close all pump discharge valves.
___B. Remove cover from pressure switch PS-4.
___C. Open controller door and close main disconnect.
___D. Place any pump HOA switch in Hand (Manual) position. The corresponding pump will run. While pump is running, monitor the TANK pressure gauge. Verify gauge reads 3 PSI above system pressure. Turn pump off if pressure is high. Close discharge faucet(s) once pressure reading is correct.
___E. Locate input LED # 3 on the PLC. This is the input to the PLC from the PS-4. LED turns on when Lead Pump runs.
___F. Viewing adjusting dial on PS-4 from top, rotate **Bottom** dial counterclockwise until dial stops. Then turn **Top** dial clockwise slowly until LED # 3 turns on. Tank pressure switch is now set.

Service and Assistance: Contact either the pump manufacture field agent or the Master Control Systems field agent for assistance. The factory can be contacted at the address and numbers shown on the next page.

MODEL SPX, DPX & etc.

Addendum No. 2 - File No. 121-24

M-PLEX Series -- Booster Pump Motor Controller

REPLACEMENT PARTS LIST

Symbol	Part No.	Description	Notes
DS	302400	Disconnect Switch, 600 Vac, 30/40 Amp (Internal Switch only)	
DS	302401	Disconnect Switch, 600 Vac, 60/80 Amp (Internal Switch only)	
DS	302402	Disconnect Switch, 600 Vac, 100 Amp (Internal Switch only)	
---	400939	Disconnect Switch Handle Operator only, (30 thru 100 Amp)	
HOA	401199	Auto-Off-Manual Selector Switch	
---	401992	Contact Block (N.O.)	
PS*	305420	Standard Pressure Switch	
PS4	305421	Tank Pressure Switch	
PLC	305580	Programmable Logic Controller (standard units only)	
---	305040	Control Power Transformer, 50 VA, 208/240/460 Vac	
---	305041	Control Power Transformer, 50 VA, 208/380/575 Vac	

Note: One or more renewal parts such as fuses, heaters, contacts, and etc. may be obtained from local electrical distributor(s).

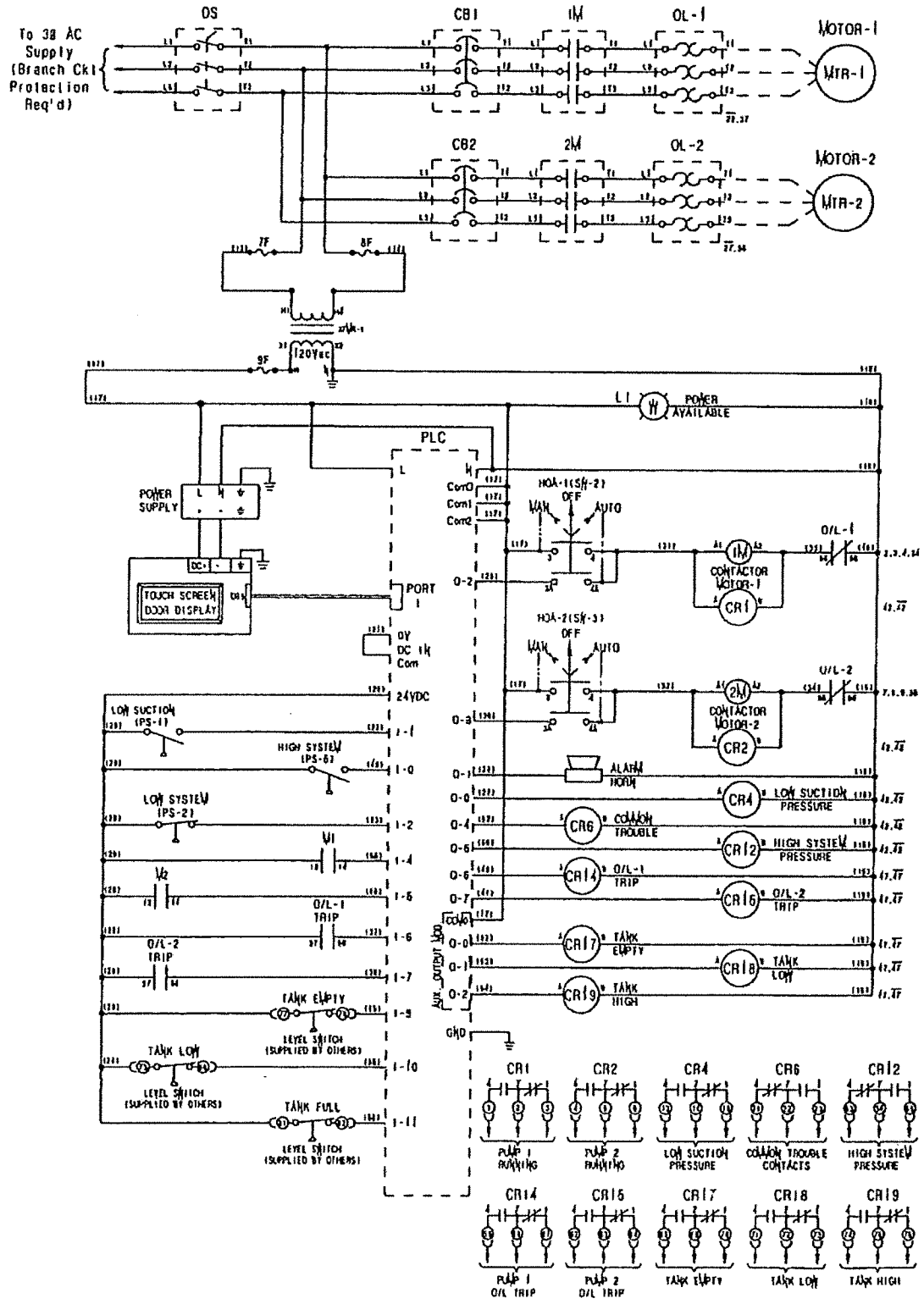
IMPORTANT: When ordering replacement parts, be sure to specify the complete MODEL NUMBER and SERIAL NUMBER of controller in which they are to be used.

MASTER CONTROL SYSTEMS, INC.
910 North Shore Drive
Lake Bluff, IL 60044 USA

Phone: 847-295-1010 Fax: 847-295-0704
E-Mail: sales@mastercontrols.com
Web Page: http://www.mastercontrols.com

DPXA Constant Pressure Booster Duplex Controller

MASTER



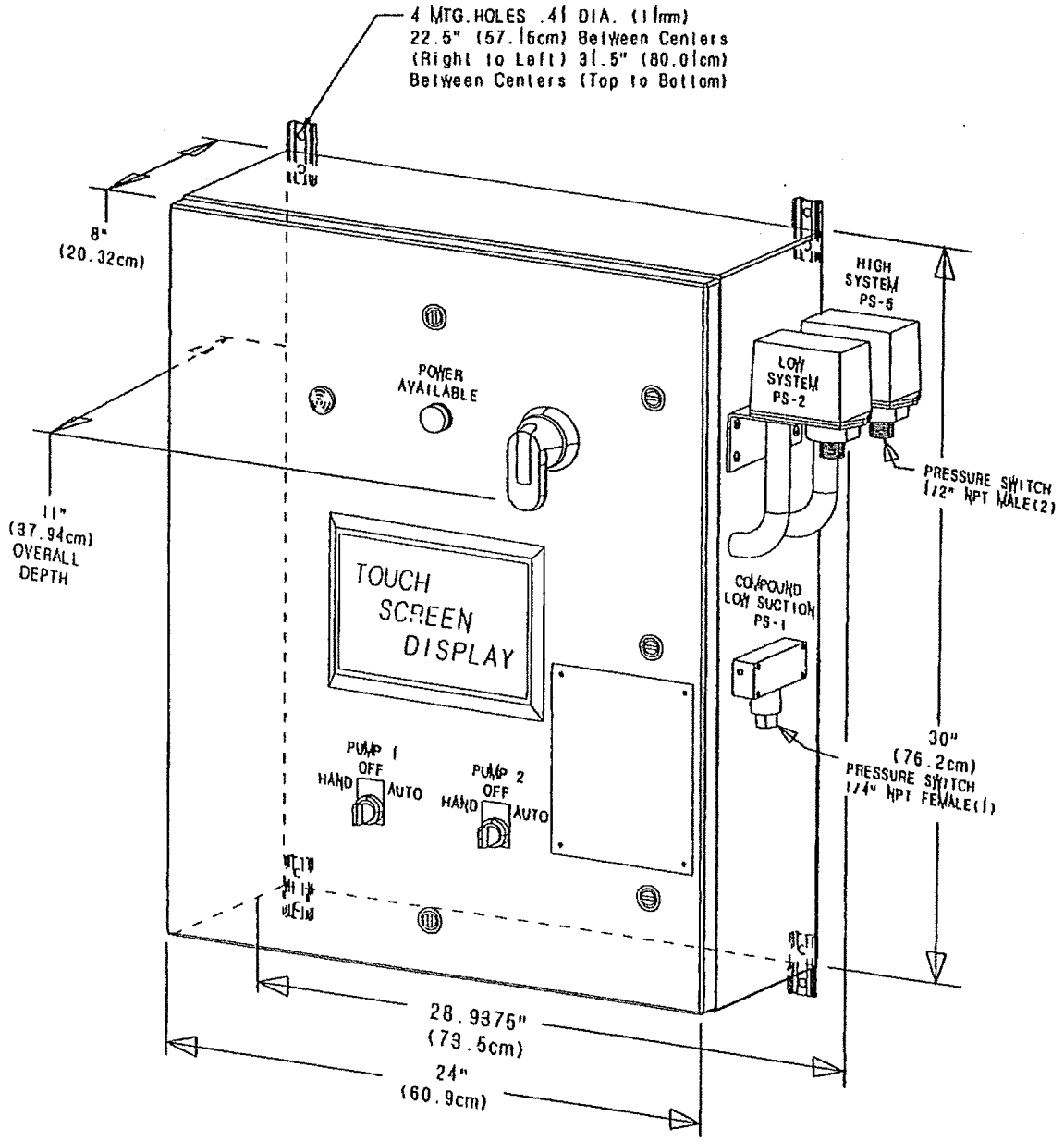
Notes:
Refer to PLC Ladder Diagram for sequencing and time delay information.

Listed

Master Control Systems Inc. LAKE BLUFF, ILLINOIS U.S.A.	Constant Pressure Booster Duplex Controller Schematic	Date	4 August 2006
		Drawing	11825 Issue 3

DPXA Constant Pressure Booster Duplex Controller

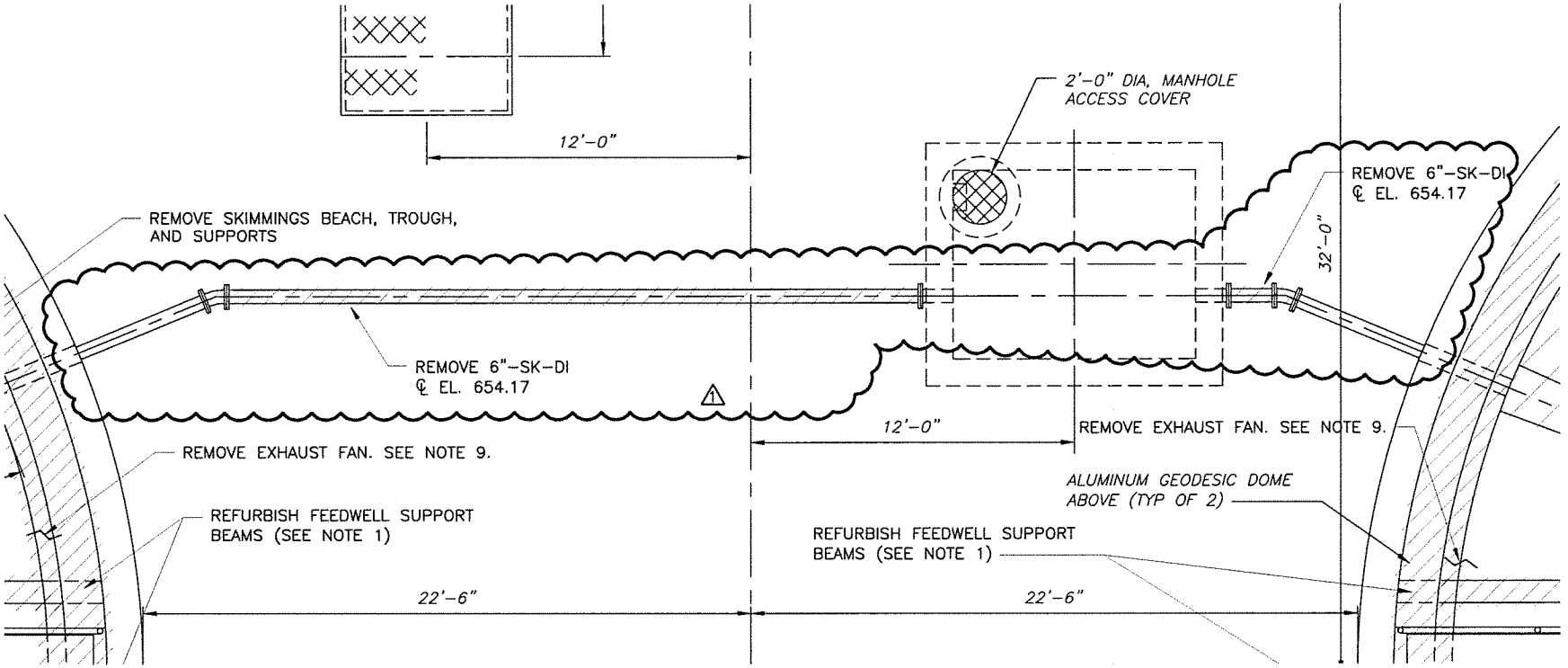
MASTER



Notes:
-Enclosure: 14 Gauge 316 Stainless Steel
-Finish: Smooth Brushed Finish
-Application: For Indoor/Outdoor Use, NEMA 4x
-Mounting: Wall Mount
-Max. Shipping Weight: 120 Lbs. (43.2kg)

UL Listed

Master Control Systems Inc. LAKE BLUFF, ILLINOIS U.S.A.	DPXA Constant Pressure Booster Duplex Controller Dimensional	Date	10 August 2006
		Drawing	11835 Issue 7



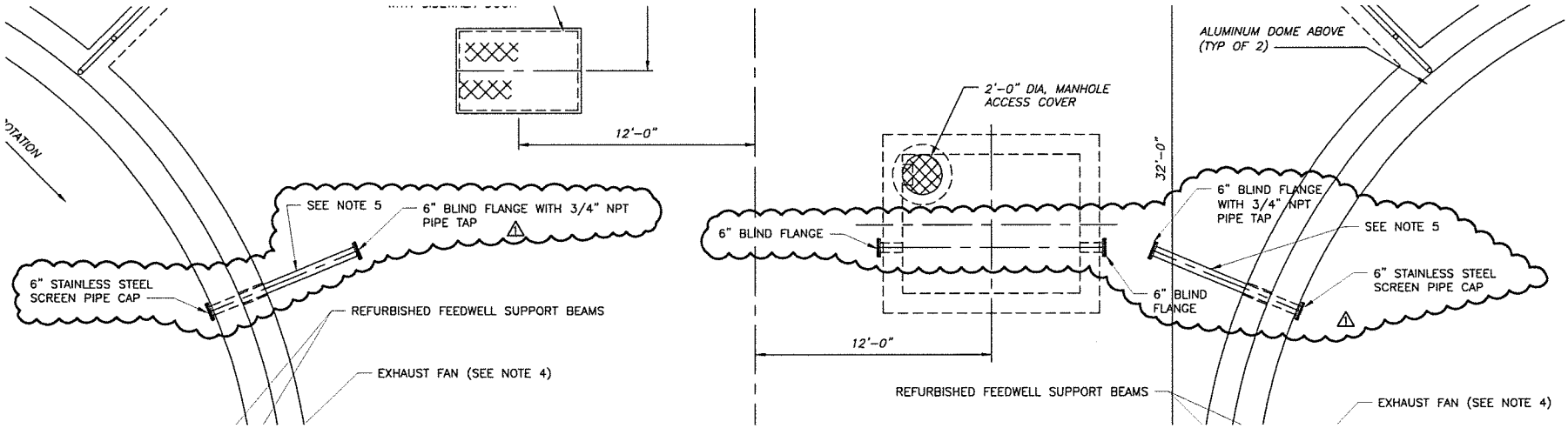
Addendum No. 2 - File No. 121-24

CDM Smith
1360 East Ninth Street, Suite 610
Cleveland, OH 44111
Tel: (216) 579-0404

CLEVELAND DIVISION OF WATER

TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS

DATE: 11/11/2024	SHEET NO.	LOCATION	ADDENDUM NO.	FIGURE NO.
FILE NAME: SK-1.DWG	C-M-2	-	2	SK-1



NOTES:
1. RAKE DRIVE REFURBISHED PER SPECIFICATION SECTION 46 43 31.
2. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CLEARANCES, DIMENSIONS, AND ELEVATIONS REQUIRED FOR PROPER EQUIPMENT REMOVAL AND INSTALLATION PRIOR TO ORDERING EQUIPMENT AND/OR BEGINNING WORK.
3. BOLT HOLES SHALL BE CLOSED USING 316 SS BOLTS AND NYLON LOCK NUTS WITH FLAT WASHERS AND NEOPRENE WASHERS ON EACH SIDE OF THE TROUGH BOLT HOLES. CONTRACTOR SHALL ASSUME 200 OPENINGS PER TANK.
4. PROVIDE EXHAUST FAN IN EXISTING GEODESIC DOME OPENING PER SPECIFICATION SECTION 13 33 13. SEE SPECIFICATION APPENDICES FOR GEODESIC DOME INFORMATION INCLUDING EXHAUST FAN LOCATION.
5. PROVIDE PIPE SUPPORT ON REMAINING SECTION OF 6"-SK-01. ⚠1

Addendum No. 2 - File No. 121-24

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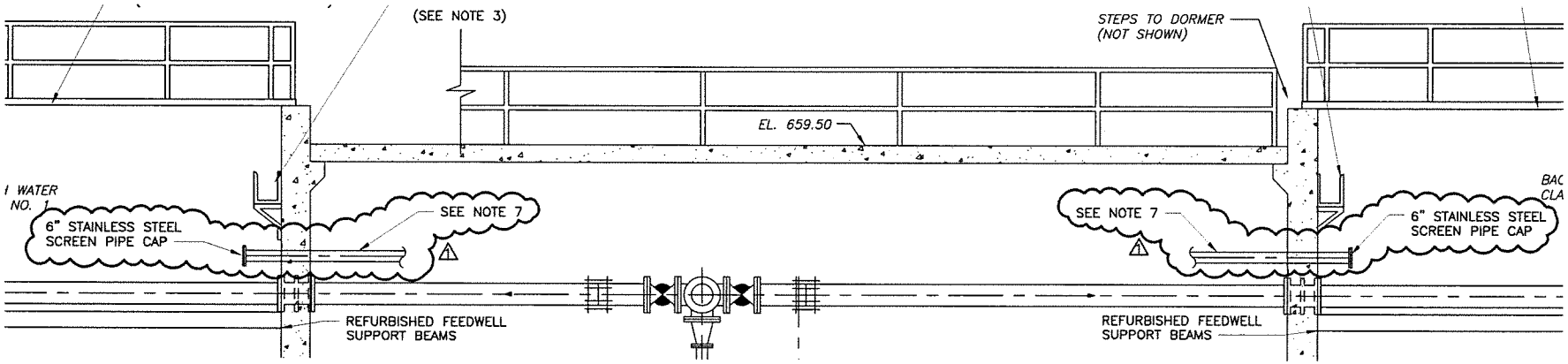
CLEVELAND DIVISION OF WATER

TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS

DATE: 1.1/11/2024	SHEET NO.	LOCATION	ADDENDUM NO.	FIGURE NO.
FILE NAME: SK-2.DWG	C-M-11	-	2	SK-2



NOTES:
1. EACH RAKE ARM CONTAINS SIX PLOWS WITH SQUEEGEES. THE OUTERMOST PLOW IS 10'–0" WIDE. THE OTHER FIVE PLOWS ARE 6'–0" WIDE. PLOWS AND SQUEEGEES SHALL BE PROVIDED BY THE ORIGINAL EQUIPMENT MANUFACTURER PER SPECIFICATION SECTION 46 43 31.
2. SLUDGE RAKE ARMS ARE SHOWN ROTATED FROM PLAN FOR CLARITY.
3. BOLT HOLES SHALL BE CLOSED USING 316 SS BOLTS AND NYLON LOCK NUTS WITH FLAT WASHERS AND NEOPRENE WASHERS ON EACH SIDE OF THE TROUGH BOLT HOLES. CONTRACTOR SHALL ASSUME 200 OPENINGS PER TANK.
4. RAKE DRIVE REFURBISHED PER SPECIFICATION SECTION 46 43 31.
5. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CLEARANCES, DIMENSIONS, AND ELEVATIONS REQUIRED FOR PROPER EQUIPMENT REMOVAL AND INSTALLATION PRIOR TO ORDERING EQUIPMENT AND/OR BEGINNING WORK.
6. PROVIDE EXHAUST FAN IN EXISTING GEODESIC DOME OPENING PER SPECIFICATION SECTION 13 33 13. SEE SPECIFICATION APPENDICES FOR GEODESIC DOME INFORMATION INCLUDING EXHAUST FAN LOCATION.
7. SEE SHEET C–M–11 FOR WORK ASSOCIATED WITH 6"–SK–DI INSIDE PUMP ROOM. ⚠

Addendum No. 2 - File No. 121-24

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CLEVELAND DIVISION OF WATER

TREATMENT PLANT RESIDUAL SYSTEMS IMPROVEMENTS

DATE: 11/11/2024	SHEET NO.	LOCATION	ADDENDUM NO.	FIGURE NO.
FILE NAME: SK–2.DWG	C-M-12	-	2	SK-3