ASHROSS LLC

OPERATIONS
AND
MAINTENANCE MANUAL

ASHROSS RAILCAR
UNLOADING MACHINE IN GROUND
(RUMig3)

ASHROSS LLC
530 South 250 West
Pleasant Grove, Utah USA 84062
Telephone: 801-785-6464
Fax: 801-785-6486
WWW.ASHROSS.COM

TITLE PAGE

Maintenance and Operation Manual
Ashross, LLC
Pleasant Grove, Utah USA 84062
Telephone: 801-785-6464
Fax: 801-785-6486
www.ashross.com

Purchase order number and/or customer identification:
Cameron Agg. Products

PO#

Serial Number:

AR-RUMig3-826-16

Manual submittal date: December 28, 2016

Author: SB/CH

Ashross RUMig

Foreword

The RUMig3 machine is designed to unload material from bottom dump rail cars. The machine is built of high quality steel, powered by six (6) electric motors three of which transfer their energy to functioning parts via a hydraulic system comprised of pumps, valves, hydraulic cylinders and lines, one (1) hydraulic oil cooler, while the other two electric motors power the main conveyor head pulley. This unit is semi-permanently installed in a shallow pit and replaces fifty feet of existing rail at the selected operating site chosen for unloading. Preparatory work at the site includes excavation to accommodate the depth of the machine that is approximately 57 inches from top of tie to bottom of the machine. The length of the unit is 50'. The width of the machine is 13' 10" not counting the conveyor exit assembly, tail pulley assembly and walkways. Steel or reinforced concrete structures must be prepared to support the machine so that the ends of two 36 inch I-beams within the machine rest on twenty-four inch purchases or landings. The landings are 36" below tie height. These I-beams act as a bridge over the fifty-foot length of the machine. Standard 115 lb. rails attached to the top of the I-beams on the machine match up with the ends of the surface rails on each end. The excavation of the ground in the operating area may be modestly below the required depth of the machine.

When a rail car is positioned on the machine, discharged material lands on or is conveyed laterally to a sixty-inch wide conveyor belt that exits the midpoint of the machine perpendicular to the line of the rails. The conveyor may be of varying lengths ranging from ten to one-hundred feet or more and is supported by legs. This machine has a conveyor about 40'-0" in length from pivot point to center of head pulley and the center of the head pulley is about 48' 7 5/8" horizontally from the center-point of the rails. The conveyor angle is approximately 15 degrees.

Within the machine and on either side of the exiting conveyor belt are a total of six (6) sets of reciprocating feeder plates. These feeder plates are made of AR steel and other materials. Each set of feeder plates have attached one (1) 4 1/2" x 36" hydraulic cylinder that causes movement of the plates. The feeder plates move the unloaded material to the conveyor belt in the center of the machine. Significant amounts of the material from the railcar will free-flow directly to the conveyor belt. Retention walls, measuring three feet above tie height to their tops, are on the out sides of the machine.
.
The speed of the conveyor belt is adjustable from about 20% of rated capacity to 100% of rated capacity in a linear fashion by using a variable frequency drive (VFD). In this application the design calls for a belt speed of about 300 feet per minute (fpm) at 60 Hz, 400 fpm at 80 Hz ranging to a low belt speed of about 100 fpm at 20 Hz. A "strike off" plate can also be used to regulate the amount of material on the belt.

One person can operate the machine and may do so after a modest amount of training. Machine controls and functions are clearly designated. Maintenance is not overly demanding in order to experience high reliability and up time. The life of the machine is essentially indefinite as to its structural integrity. Individual parts are of high quality and their life is consistent with similar applications using such parts.

Certain concepts, functions and designs of the machine are pending patent approval under United States of America patent laws and international rights have been reserved.

TABLE OF CONTENTS

2.1 THEORY OF OPERATION

The RUMig3 is designed to handle material from bottom dump rail cars. It is located on a semi-permanent site that requires excavation as little as a minimum of five feet below top of tie. This is possible because material moves horizontally via feeder plates onto the conveyor belt. Rail engines can also move across the machine. When the machine is not being used to unload material, rail cars and rail engines can pass over the machine.

The RUMig3 is self-contained and can be moved from manufacture location to operating site over public highways with appropriately sized truck/trailer carriers (Figure 1). The main unit is less than 14' in width. The conveyor, exit assembly, tail pulley assembly, support legs, walkways and belt are assembled on site. Other components of the machine, such as the electric panels and hydraulic power unit (HPU) come fully operational and assembled and need only be connected to appropriate electric power and then to components on the machine.

Figure 1

The RUMig3 machine is designed to unload materials from bottom dump rail cars. It is built of high quality steel and is powered by electric motors. This unit is semi-

permanently installed, it is 50’ in length and replaces fifty feet of existing rail at the selected operating site chosen for unloading. Required preparatory work (Figure 2) at the site includes excavation to accommodate the depth of the machine that is approximately 57 inches from top of tie to bottom of machine and a width of approximately 13’ 10” not counting walkways, tail pulley assembly or exist assembly. Steel or reinforced concrete structures must be prepared to support the machine so that the ends of two 36 inch I-beams of the machine rest on about twenty-four inch purchases or landings. These I-beams act as a bridge over the fifty-foot length of the machine. The standard 115 lb. rails on the machine match up with the ends of surface rails at each end (Figure 3). The excavation of the ground in the operating area may be modestly below the required depth of the machine.

Figure 2


Figure 3

When a rail car is positioned on the machine, discharged material is moved to a sixty-inch wide belt that exits the midpoint of the machine perpendicular to the line of the rails. The main conveyor may be of varying lengths ranging from ten to one-hundred feet and is supported by legs. This machine has a conveyor about 49’-6” in length from pivot point to center of head pulley and the center of the head pulley is about 57’-4 1/8” horizontally from the center-point of the rails. The conveyor angle is approximately 15 degrees. Within the machine and on either side of the exiting conveyor belt are a total of

six (6) sets of reciprocating feeder plates (Figure 4). These feeder plates are made of AR steel and other materials. Each set of feeder plates have attached one (1) 4 1/2" x 36" hydraulic cylinder that causes movement of the plates. The feeder plates move the unloaded material to the conveyor belt in the center of the machine. Significant amounts of the material from the railcar will free-flow directly to the conveyor belt. Retention walls, measuring three feet above tie height to their tops, are on the out sides of the machine. This allows material from the bottom dump railcars to be contained within the body of the machine.

Figure 4

The speed of the conveyor belt is adjustable from about 20% of rated capacity to 100% of rated capacity in a linear fashion by using a variable frequency drive (VFD). In this application the design calls for a belt speed of about 300 feet per minute at 60 Hz, about 400 fpm at 80 Hz ranging to a low belt speed of about 100 feet per minute at 20 Hz. A "strike off" plate can also be used to regulate the amount of material on the belt. Figure 4b shows the conveyor.

Figure 4b

One person can operate the machine and may do so after a modest amount of training. Machine controls and functions are clearly designated at various electrical control boxes such as EC BOX-1A (Figure 5) and EC BOX-2A (Figure 5a). Maintenance is not overly demanding in order to experience high reliability and up time. The life of the machine is

essentially indefinite as to its structural integrity. Individual parts are of high quality and their life is consistent with similar applications using such parts.

Figure 5

Figure 5a

When the machine is fully operational and provision has been made to handle the material once it leaves the main conveyor, a railcar is moved onto the machine, centered and its gates opened (Figure 6). The speed of the conveyor belt is adjusted to meet the capacity of the receiving belt system or storage area. The "strike-off" plate can be used to adjust the amount of material on the belt.


Figure 6

The machine is equipped with a "PLUS+ 1" system to electronically control certain hydraulic functions. The PLUS+1 system has a micro-controller that is programmed to synchronize the amount of hydraulic oil to each cylinder. The cylinder shafts will extend or retract to 100% of their length.

3.1.1 ELECTRIC POWER

There are several electrical control boxes. The first box is labeled EC BOX-1A and contains the VFD among other electrical controls (Figures 9 and 10). The second box is labeled EC BOX-2A and has the PLC and Panel View screen (Figure 9a). The third box is labeled EC BOX-3A and contains the scale (Figure 9b). The fourth box is labeled EC BOX-4A and contains buttons for controlling machine operational functions (Figure 9c). The fifth box is labeled EC BOX-5A and is the controller that manages the PLUS+ 1 feature controlling the hydraulic cylinders (Figure 9d). EC BOX's 1A, 2A and 3A are mounted on the same stand-alone frame that contains the hydraulic Power Unit (HPU). EC BOX's 4A and 5A are mounted on the machine near the hydraulic valve bank and controls. Electrical service calls for: 480 V, 60 Hz, 640 Full Load amps, three phase. Leads from EC BOX-1A power panel go to two electric motors on the conveyor head pulley (Figure 12) and to the three electric motors on the HPU that provide power to three hydraulic pumps (Figure 9e). Other leads go to safety devices and to the other electrical boxes. Electric cables are shipped with the machine and connection points labeled accordingly.

Figure 9

Figure 9a

Figure 9b

Figure 9c

Figure 9d

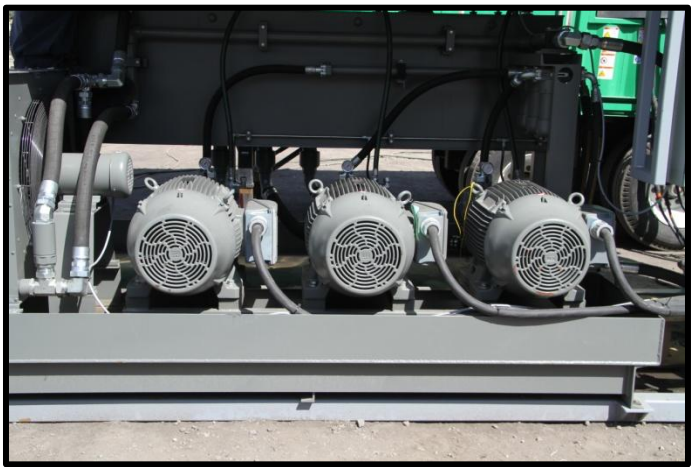


Figure 9e

3.1.2 CONTROLS

In general the machine is designed to be controlled through the use of a programmable logic control (PLC). Signals activate electric power for one head pulley motor and for three electric motors serving the hydraulic functions and originate with the PLC. In like manner controls that start the belt, the feeder plates and related hydraulic functions are defined within the programming of the PLC. There are five electric control panels or boxes for the machine. Detailed descriptions and functional layouts are within this manual in the section 3.2 titled “Description of Operation.” The functions of all electric control boxes and the hydraulic valve bank are contained therein.

Figure 10

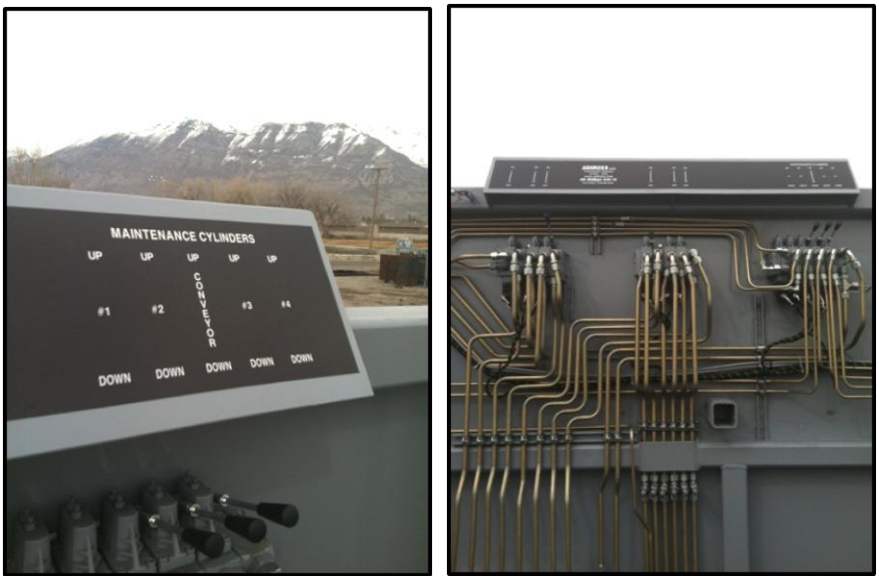


Figure 11

3.1.3 MAIN CONVEYOR HEAD PULLEY, MOTORS AND GEAR BOXES

The head pulley for the main conveyor is shown in Figure 12 along with the electric motor and gearbox. This motor and gearbox turn the head pulley. The Head pulley cylinder is a 24” diameter ceramic lagged drum 64” long mounted on a 7 1/2” diameter shaft that is tapered to 5 15/16” diameter at the bearings and tapered to 4” diameter at the gear box. The electric motor and gearbox is fitted on the shaft. The gearbox has a feature that prevents the head pulley from turning backwards when the electric power is turned off. The gearboxes have a 40.19:1 reduction ratio. The lubricant for the gearbox should be SHELL OMALA S4 GX22. The torque arm is attached to the frame of the

conveyor. A primary belt wiper is mounted inside the dis-charge area and is engaged with the head pulley.

Figure 12

The tail pulley (Figure 12a) is mounted in a take-up frame with a 36" range of adjustment that facilitates tightening and training the belt as well as providing slack for replacement of the belt. The exit assembly (Figure 12b) contains hold-down rollers and provides the attachment point for the conveyor.

Figure 12a

Figure 12b

3.1.4 POWER AND CONTROLS

Main electric service to the power panel is 480 V, 60 Hz, 640 Full Load amps, three phase. A variable frequency drive (VFD) activates the one 75 KW (100 HP) motor on the conveyor head pulley. Three 75KW (100 HP) motors power three hydraulic pumps.

Material from the railcars land in the hoppers of the machine and is moved laterally by the feeder plates to the dis-charge conveyor. By using the PLC the RUMig3 may be configured so it is dependent on the operational status of downstream conveyors or other

related equipment. With this arrangement, if downstream conveyors are operating then the RUMig3 may operate. If downstream conveyors stop operating, the RUMig3 will stop.

Care must be taken to assure that the hydraulic fluid level in the hydraulic supply tank is kept within the range shown on the sight gauge. Use Rando-HD ISO 32 (Chevron) or equivalent grade hydraulic oil in a normal operating environment or appropriate SAE weight oil acquired from a reliable manufacturer when extreme temperatures dictate. The tank comes filled with a supply of Rando-HD ISO 32 oil. Capacity of the hydraulic tank is about 350 gallons. Care should be taken to not over fill the tank. There are sensors that provide alarms if the oil level is too low or if the oil temperature is too high.

3.1.5 CONVEYOR

The conveyor extends approximately 40’ from the pivot point on the side of the machine to the center of the head pulley and the center of the head pulley is about 48’ 7 5/8” horizontally from the center line (CL) of the rails. The angle of the conveyor is designed to be about 15^0. The 60” wide belt is continuous and may be joined together with a Flexco R5-Rivot Fastener, recessed top and bottom, or joined by cold or heated vulcanizing. The belt is rated 330, 3 ply, with 1/4” top and 1/16” bottom, 60” wide and final belt length is about 142’.

The conveyor is supported by a set of steel legs that are normally adjustable but at the request of the customer their length is fixed (Figure 13). Steel plates are attached to the bottom end of each of two legs shown in (Figure 14). It is understood these plates will sit on concrete surfaces that will support the weight of the conveyor, the weight of the legs combined with the weight of the material on the conveyor.

Figure 13

Figure 14

The conveyor belt is installed by beginning at the return point where the belt enters the main machine or over any return roller. Ropes or cables attached to a short piece of belt connected to the end of the belt will facilitate threading the belt through the machine and up the conveyor. If the ropes or cable are long enough the head pulley can help pull the belt if care is taken. This is possible in the "maintenance" mode. The tail pulley take-up frame can be used to tighten and train the belt.

3.1.6 STRUCTURAL ELEMENTS AND LIFTING DEVICES

Two 36" I-beams 50' long form the central structural elements of the machine and have sufficient strength to bridge fifty feet from end to end. Permanent support or structural elements must be prepared to support the ends of the machine. These support elements must provide places of purchase or ledges about 24" wide on which the bottom of the ends of I-beams sit. The top of these support structures are 36" below the top of the ties. These structural elements must be engineered to support the weight of the machine, loaded rail cars and/or engines. The machine itself is engineered to support those weights and to bridge the span.

The sidewalls or retention walls of the machine are 36" above the tie height and will contain material discharged from the rail cars. Interior clearance from wall to wall is about 12' 4". Outside overall width of sidewalls is about 13' 10".

Hydraulic lifting cylinders are positioned at the ends of the machine and integrated within the sidewalls. Companion safety stands adjoin the lifting cylinders shown in Figure 8. The machine may be lifted 24 inches from its support ledges or purchase points by the hydraulic cylinders to facilitate servicing of the machine or cleaning up spilled material. When this is done the safety stands must be lowered and pinned to assure that the machine cannot drop in the event of hydraulic pressure failure. The conveyor rises in synchronization with the main machine. Be sure the feet of both the lifting cylinders and safety stands are on surfaces capable of supporting the weight of the machine.

3.1.7 OPERATIONAL PRACTICES AND RISK MITIGATION

An emergency stop or "E Stop" is provided at EC BOX-2A. Pull-cords or E-Stops are located along both sides of the machine and on either side of the conveyor. Personnel managing the unloading of the railcars will be in proximity to these safety devices. *Note that resetting the E stops or pull cords does not energize the machine.*

Figure 15

Before lifting the machine take all appropriate safety steps to assure that rail traffic from both directions is stopped and the tracks properly flagged. When the machine is lifted by the hydraulic lifting cylinders, set in place the safety stands and pin them immediately. These stands are physically pinned to assure that the machine cannot drop in the unlikely event of hydraulic pressure failure. No one should work under the machine when it is raised without the safety stands in place. Prior to lowering the machine make sure the support elements where the 36" I-beams sit are clear of material and that pins are removed from the safety stands . When the machine is not in operation it should remain in its lowered position and not suspended by the lifting cylinders or safety stands.

3.1.8 INSTALLATION

The machine arrives at the work site in various components. These components include the main body of the machine, conveyor sections with installed head pulley on one, conveyor, exit assembly, tail pulley assembly, walkways, and support legs for the conveyor, hydraulic power unit (HPU) and conveyor belt.

Installation will include inspecting all components for any possible damage resulting from shipping. Installation can be accomplished in the following order.

1. Set the main unit of the machine on its mounting points in the previously prepared pit. Cause surface rails to be brought to within ½" of the rails on the machine. This space is required so the machine can be lifted for servicing. Consider installing guides on the mounting surface adjacent to the insides of the I-beams of the machine on each end. The purpose of these guides is to assure that when the machine is lifted it will return to its correct orientation with the surface rails. This might take the form of an inverted piece of 90^0 angle iron.
2. Install the tail pulley assembly on the main machine but do not install the protective side screens because access will be needed to install the conveyor belt. The protective side screens can be installed later.
3. Attach the conveyor exit assembly to the main body of the machine. (Figure 12b) **NOTE**: If machine is equipped with walkways: The walkway over the exit assembly must be installed before the conveyor is installed.
4. Attach the conveyor to the exit assembly. Take care to properly brace and support the conveyor so no damage occurs to the head pulley, electric motors, gear boxes and electrical and hydraulic lines on the sides of the conveyor.
5. Prepare the conveyor support legs for installation. The legs are shipped attached to the conveyor. Rotate the legs 90 degrees under the conveyor.
6. Lift the conveyor and position the legs on the prepared support surface.
7. Set the Hydraulic Power Unit (HPU) and attached electrical panels in place. This placement is important since the length of hydraulic lines and electrical cables are based upon correct positioning of the HPU steel frame. Be sure the frame is sitting on a surface that is flat with the electrical panel on the end of the HPU metal frame oriented to be closest to the main body of the machine.
8. There are three hydraulic lines coiled in the spill containment pan of the HPU. Extend these hydraulic lines to the side of the conveyor and connect it to the "quick connect" fitting on the side of the main frame. The lines are already charged with hydraulic fluid.
9. There are two or more electric cables coiled on the conveyor. Uncoil one 120V cable, with the big plug, and connect it to the bottom of the panel marked EC BOX-2A mounted on the frame for the HPU. Its end and connection point is labeled on the bottom of the panel. This power serves Pull Cords, E-Stops, Strobe lights, Horn, Misalignment switch and Zero Speed switch on the machine. The remaining electric cable is labeled M4. This should be uncoiled, and connected to marked points in the panel marked EC BOX-1A mounted on the HPU frame. **NOTE:** There may be other cables that operate the electric brakes on the head pulley motors that will need to be connected to marked points in the EC BOX-1A mounted on the HPU frame.
10. Surface power should be connected to the electrical power panel marked EC BOX-1A. Prior to shipping all five (5) electric motors – 1 for the head pulley and 3 for the hydraulic pumps and one (1) for the hydraulic oil cooler- have been correctly wired to assure they are turning the correct direction. Once surface power is connected inside of EC BOX-1A the motors will need to be tested for the proper rotation. What has to be done is "**bump**" the power to the hydraulic oil cooler.

11. The following is the sequence of testing rotation: Turn off the main power (Main dis-connect switch)
12. Open the doors on EC BOX-1A.
13. Turn off the breakers for M1, M2, and M3. (These are the three motors that operate the hydraulic pumps).
14. Close the doors on the large electric power panel.
15. Turn the main power back on.
16. With the main power on go to the Panel-View screen and find the "Mode" screen.
17. On the mode screen select "Maintenance" mode.
18. Select the maintenance screen.
19. On the maintenance screen select "Start" for HPU #1(the motor will not start). The alarm will sound for five seconds and then the power will go to the electric motor for the hydraulic oil cooler.
20. Select "Off" immediately and observe the direction of the cooling fan that was started briefly ("bumped") and compare it to the directional arrow on the fan cowling. If the direction is correct nothing more need be done. If the direction is wrong, then the surface power leads to the electrical panel (EC BOX-1A) need to be reversed and the above process repeated. When the oil cooler motor runs the correct direction then the other four motors will run the correct direction. **DO NOT CHANGE THE ASHROSS SUPPLIED WIRING.**
21. Verify that hydraulic oil in the hydraulic oil tank is at its correct level. Note that the hydraulic ball valves are shipped in an operate mode and do not need to be changed (Handle in line with the hose).
22. Install the conveyor belt by beginning at the point where the belt returns to the machine or over any return roller on the bottom of the conveyor. Be sure the belt is threaded correctly under the return roller on the exit assembly. Then over the lagged self-aligning roller. Continue around the tail pulley and back across the deck of the machine. Wipers in the machine are hinged and can be lifted to facilitate this threading. The tail pulley has about 36" of adjustment and loosening will help during belt installation. Pull the belt up the conveyor, around the head pulley and then back on the return rollers (the head pulley can be used at any point to help pull the belt). Join the belt by vulcanizing or with a cable at the metal fasteners. Adjust tension and tracking with the tail pulley.
23. At the PanelView screen select "Maintenance" mode, then select conveyor belt speed. Using the "PANELVIEW" adjust the belt speed to 50 FPM (about 50%). Note: The belt speed is based upon a percentage from 0% to 100%, 100% being 80 Hz and 0% being 0 Hz. Observe the belt tracking and tension and make appropriate adjustments at the tail pulley. Note: Let belt run for several minutes before assuming it will track correctly.
24. Observe that the belt speed is being displayed and confirm with a hand-held belt speed device that the speed displayed is correct.
25. Test the hydraulic system by activating all three hydraulic motors at the PanelView screen while still in "Maintenance" mode. Start the feeder plates and observe that they are moving freely. When the feeder plates are turned on with the "ON" button the plates run until a timer turns them off. The timer is set for 30 seconds at the factory but this time can be adjusted up or down at the Panel View

screen. Confirm that the timer is set correctly and turns off the feeder plates. Test that the lifting cylinders work. One need not lift the machine completely but it is important to know that the machine is oriented correctly with the surface rails when the I-beams are back on their support surfaces.

26. Place the protective screens on the tail pulley.
27. Start the conveyor belt and adjust the belt speed from very slow to faster using the panel-view screen. Observe that tracking and tensioning of the belt is correct.
28. Check over the machine for any leaks from hydraulic fittings at the hydraulic valve bank and at hydraulic cylinders under the machine. Tighten fittings that may be leaking.
29. Go from maintenance mode to "Central Control" and operate all functions at the EC BOX-2A on the panel view on the Central control screen in this mode.
30. Go to "Local Control" mode and test all functions at the EC BOX- 4 and hydraulic valve banks on the machine.
31. During one of the tests verify the E-Stop buttons work. Learn to observe the resulting "faults" on the PanelView screen and clear the faults. Test the pull cords in like manner.
32. If used: Verify that the downstream interlock is functioning by operating the downstream equipment.
33. When satisfied with the previous testing consider bringing a railcar onto the machine and unload material.

3.2 Description of Operation

RUMig3-822 Description of Operation Rev. 001 03/17/16

The RUMig3-822 is designed to unload bottom-dump railcars one car at a time. The main body of the machine is 13' 10" wide, not counting the walkways, conveyor exit assembly and tail pulley assembly, and 50' 0" long. There are six (6) sets of reciprocating feeder plates with two (2) sets between the rails and four (4) sets outside the rails. These feeder plates reciprocate back and forth and move the unloaded material to one exiting conveyor belt in the center of the machine. Significant amounts of the material from the railcar will free-flow to the conveyor belt.

Among several electric power control panels is one (EC BOX-2A) that comes equipped with an Allen Bradley PLC model Compact Logix 1769-L30ER processor with 5000 series software and an Allen Bradley Panel-View Plus 2711P-T7C4A8 with a 7" screen. Ethernet communication is used between components.

A 60" wide belt in the exiting conveyor carries the discharged material onto other conveyors or transport vehicles. The belt is driven by one (1) electric motor attached to gear reducers at the 19" diameter ceramic-surfaced head pulley. The electric motor is rated 57KW (75 HP) and the gear reducers have a 70.95:1 ratio. Speed of the electric motors is controlled by an Allen Bradley variable frequency drive (VFD). The speed of the belt will approximate 130 feet per minute (fpm) at 60 Hz, 175 fpm at 80 HZ and a low of 45 fpm at 20 Hz.

Power for the feeder plates comes from a hydraulic power unit (HPU) that supplies the hydraulic oil. Each set of reciprocating feeder plates have attached one (1) 4 1/2" x 36" hydraulic cylinder that causes movement of the plates. The HPU has three (3) electric motors with each motor rated at 75KW (100 HP). Each electric motor has one hydraulic pump mounted to it. The hydraulic system uses load-sensing technology. With feeder plates turned off there is minimal hydraulic pressure when the HPU electric motors are started. As work demand increases for hydraulic cylinders the load-sensing causes the hydraulic pressure to increase to meet or exceed demand.

There are several electrical control boxes. The first box is labeled EC BOX-1A and contains the VFD among other electrical controls. The second box is labeled EC BOX-2A and has the Panel-View screen, one (1) VFD display and PLC. The third box is labeled EC BOX-3A and contains the belt scale read out. The fourth box is labeled EC BOX- 4A and contains buttons for controlling machine operational functions. The fifth box is labeled EC BOX-5A and is the micro-controller that manages the PLUS+ 1 features controlling the hydraulic cylinders. EC BOX's 1A, 2A and 3A are mounted on the same stand-alone frame that contains the Hydraulic Power Unit (HPU). EC BOX's 4A and 5A are mounted on the machine near the hydraulic valve bank and controls. These five electrical control enclosures are rated at a NEMA 4X classification. EC BOX-1A has on its panel door one (1) "Main Power Disconnect". EC BOX-2A has one (1) "Main Power On" (amber) light, one (1) Allen Bradley panel-view touch screen for the PLC, one (1) emergency stop pushbutton (E-Stop) and one (1) VFD display. There are two audible warning horns and two strobe lights. One set is located on the side of the machine opposite the conveyor. The other pair is located near the head pulley. When either the conveyor belt or the HPU is started the audible alarms will sound for five seconds and then stop. At the same time the two warning strobe lights will begin to flash and will continue to flash until all operating equipment is stopped.

The PLC is programmed so that when the conveyor belt is started the audible warning alarms will sound for five seconds and then stop. The strobe lights will also start and continue. At the end of the five second alarm the electric motor on the conveyor head pulley will start and ramp up to full speed (soft start) over five seconds. The conveyor belt will be at full speed ten seconds after the Start button is pushed.

The three electric motors on the HPU will not start at the same time when the conveyor belt is starting. When starting the HPU electric motors the audible warning alarms will sound for five seconds. The strobe lights will also start and continue to flash. If other equipment is operating the strobe lights will already be flashing. Following the five second audible alarm period the first of the electric motors will start followed by a three second delay. The second electric motor will then start followed by a three second delay at which time the third electric motor will start. Once started the HPU electric motors will continue to run until an "HPU Stop" command is activated. Feeder plates are turned on or off with a separate control.

The following sections describe the functions possible when each of the three (3) operating modes is selected on the panel-view screen. The operating mode choices are, reading left to right, "Central Control", "Local Control" and "Maintenance". **The system is programmed so the machine will continue to run when switching from Central Control to Local Control or from Local Control to Central Control. The machine**

will SHUT DOWN when going from Central Control or Local Control to Maintenance mode.

CENTRAL CONTROL

On the panel door of EC BOX-2A is a Panel-View screen, a Main Power on light (amber), an E-Stop and a VFD display. EC BOX-1A has a main power disconnect on the front or side of the door.

Selection of one of the three operating modes is made at the panel-view screen located on the front of EC BOX-2A. The three choices are displayed with the left position being Central Control, the center position Local Control and the right position Maintenance.

The PLC is programmed to rely upon receiving a signal from downstream equipment before any functions on the machine can be activated which is called being "interlocked." If there are no downstream dependencies a jumper wire will disable this interlock control. The panel-view will show the "interlocked" status.

When "Central Control" mode is chosen the operator is able to use the panel-view screen on EC BOX-2A to start the electric motor for the conveyor belt and the three electric motors for the HPU which start one at a time in sequence. The conveyor belt and the HPU must be started separately from one another. The order of starting does not matter. When starting the HPU electric motors the audible warning alarms will sound for five seconds. The strobe lights will also start and continue to flash. If the conveyor is already operating the strobe lights will already be flashing. Following the five second audible alarm period the first of the electric motors will start followed by a three second delay. The second electric motor will then start followed by a three second delay and then the third electric motor will start. Once started the HPU electric motors will continue to run until the "HPU STOP" command is activated. The HPU would normally be started before the conveyor belt is started. Feeder plates are turned on with separate controls. There is a "System Stop" button on the panel-view screen that will immediately stop the conveyor belt and the feeder plates. Note: The HPU will continue to run until the "HPU STOP" button is pushed.

The speed of the conveyor belt is set using the panel-view screen. The speed chosen remains active if the belt is stopped. When the belt is re-started the speed the belt was running at before being stopped will repeat until specifically changed.

From time of start the conveyor belt ramps-up to the selected set speed over a five second period. This ramp-up five second time is set for the belt in the VFD parameters and is called a "soft start". This time interval can be changed.

The operator may also start and stop the feeder plates by selecting "Feeder Start" on the panel-view screen. When in the "OFF" position the hydraulic pumps go into a standby status resulting in minimal (200-500 PSI) hydraulic pressure when the electric motors are started. When the feeder plates are started the hydraulic pumps go to run status and the required pressure to the feeder plates is determined by the "load sensing" feature of the hydraulic pumps.

Faults for various indicators on the machine are displayed on the "Fault Screen" on the panel-view screen.

These include:

E-Stop
Pull Cord

VFD Fault
Zero Belt Speed
Belt Misalignment
Head Chute Plug
High Hydraulic Oil Temperature
Low Hydraulic Oil Level
Cooling Fan Overload
Three electric motors for the HPU

Faults and Hz/Amps are displayed on two different screens for the various electric motors. The Panel-View screen shows electric motors not served by the VFD and the VFD screen shows motors the VFD serves.

Panel View Screen

Fault Screen:
HPU Electric Motors (specific)
Cooler Electric Motor (specific)

Hz/Amps:
HPU Electric Motors (specific)
Cooler Electric Motor (no display)

VFD Display

Fault:
Conveyor Electric Motors (not specific)

Hz/Amps:
Conveyor Electric Motors (not specific)

Once the "System Stop" button in the panel-view screen is touched the conveyor belt and feeder plates stop immediately. Note: The HPU will continue to run until the "HPU STOP" button is pushed.

LOCAL CONTROL

Selection of one of the three operating modes is made at the panel-view screen located on the front panel of EC BOX-2A. The three choices are displayed with the second from the left position being "Local Control". The PLC is programmed to rely upon receiving a signal from downstream equipment before any functions on the machine can be activated which is called being "interlocked." If there are no downstream dependencies a jumper wire will disable interlock control. The panel-view will show the "interlocked" status.
In "Local Control" mode most functions of the machine are controlled from the EC BOX-4A panel. However, functions that do continue to work on EC BOX-2A panel are the ability to change the speed of the belt, monitor the status of motors and settings, change the mode selection and receive fault indications.
Controls at the EC BOX-4A panel are divided into two sections. There is an Emergency stop button on the top of the box. The left section is called "Common", and the right section is called "Conveyor."
"Common" (left) section has the following functions, lights or buttons:

Machine raise/Lower (3 position spring centered switch, left=lift, right=lower)
Feeder Plates Start (Black Button)
General Fault (Red Light)

"Conveyor" (right) section has the following functions or buttons:

Belt Start	(Green Button)
Belt Stop	(Red Button)
System Reset	(Black Button)

Maintenance (located between "Common" and "Conveyor")

HPU Start	(Green Button)
HPU Stop	(Red Button)
System Stop	(Red Button)

Various fault signals can occur while in Local Control EC BOX- 4A mode. When a fault occurs the General Fault light (red) on EC BOX-4A will illuminate. When the fault is remedied the System Reset button (black) should be pushed which will reset and clear all electrical faults which will allow operations to be started. An example of a fault would be a Zero Belt Speed fault signaling that the conveyor belt is stopped. This particular fault is different in one respect from other faults. The Zero Belt Speed fault has a delay of two seconds before it becomes operative which allows time for the conveyor belt to get up to speed when being started.
When the Belt Stop button is pushed the belt stops immediately and this action will also stop the feeders. Note: The HPU will continue to run until the stop button for the HPU is pushed which will stop the HPU immediately.

MAINTENANCE

The Maintenance mode allows EC BOX-1A, EC BOX-2A, EC BOX-3A, EC BOX-4A and EC BOX-5A electrical panels to be operative at the same time. If there is an Interlock or Downstream Dependency it will **"not"** be operative.
Each of the electric motors at the HPU can be turned on independently.
In Maintenance mode the Zero Belt Speed fault is **"not"** operative. This allows very slow movement of the conveyor belt so a new belt can be installed or other service work completed. The five second ramp-up function for the conveyor belt is still operative.
If the HPU is turned on the feeder plates can be manipulated individually at the hydraulic valve bank.
Lifting cylinders can be used to lift the main body of the machine to allow for cleaning and servicing activities.
Faults remain operative in the Maintenance mode except for the Zero Belt Speed.

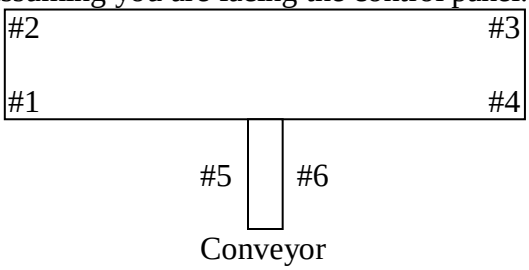
Lifting/Lowering

In Maintenance mode there are two locations for controlling the machine lift/lower function. One is located on the Panel View in the screen labeled "Maintenance," and the other is a three position spring centered selector switch located on EC BOX-4A.
For example, if you are located at the EC BOX-4A panel and the three-position switch labeled "Maintenance" is turned to the left the machine will "lift". An electric signal is sent from the PLUS+1 micro-controller causing five hydraulic valves to regulate the oil flow to all six hydraulic cylinders that lift the machine and conveyor up 2 feet for maintenance. This electronically controlled function is set to lift the machine 100% of cylinder travel distance. Lifting cylinders may also be controlled manually using the handles on the valves marked "Maintenance Cylinders".

The five manual handles are labeled as follows:

Up #1 Down	Up #2 Down	Up Conveyor Down	Up #3 Down	Up #4 Down

These numbers correspond to the numbering of hydraulic cylinders on the machine as demonstrated below assuming you are facing the control panel:



Manual safety stands are located at each hydraulic cylinder. All six (6) pins must be inserted in the safety stands after the machine is lifted before anyone works on or under the machine. Note: The safety stand feature of the legs under the conveyor uses holes that will align near the top of each support leg.

Lowering the machine:

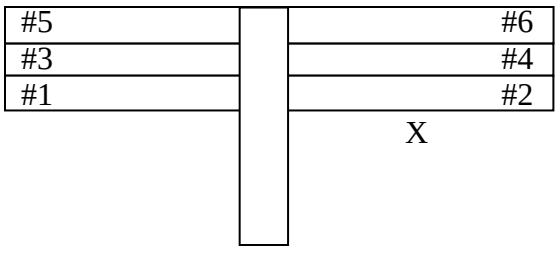
1. Verify that there is no material on the surfaces where the I-Beams will be seated, that no tools or other equipment has been left under surfaces that will be lowered and that all personnel are away from the machine.
2. Remove the safety pins from the safety stands.
3. Turn the three position switch on EC BOX-4A to the right which is labeled "Lower". This will automatically lower the machine 100% of the way.

Feeder Plates

There are six feeder plates on the machine. When in the Local or Central operate mode and the feeder plates are activated, all six go on at once and continue until timed out or stopped otherwise. When in the Maintenance operate mode each feeder plate can be controlled separately. This control is accomplished by using manual handles at the hydraulic valve bank labeled "Feeder." Each control is labeled as follows:

On #1 Feeder	On #3 Feeder	On #5 Feeder	On #2 Feeder	On #4 Feeder	On #6 Feeder
Off	Off	Off	Off	Off	Off

This numbering system corresponds to the feeder plates on the machine as though you are facing the valve bank as shown below with an "X":



Left Right

Note that the quantity of hydraulic flow to each feeder plate has been pre-set in the hydraulic valves which are activated by the PLUS+1 system. When the Maintenance mode is used the amount of flow can be adjusted at the valve bank but once the manual process is finished the hydraulic flow rate will revert to the pre-set amount through the PLUS+1 system.

PLUS+1 Micro-Controller Functions

The machine is equipped with a system to electronically control certain hydraulic functions. The system electronically senses the position of the rods in the six hydraulic lifting cylinders and regulates the flow of fluid to each cylinder so that each cylinder stays synchronized with the other cylinders. It also regulates the flow of hydraulic fluid to each of the six feeder plates and also when they reverse direction.
Six hydraulic cylinders move the six sets of feeder plates. The hydraulic cylinders reverse direction when an electronic sensor within each cylinder signals the PLUS+1 controller the position of the hydraulic rod within its stroke. The controller opens or closes valves in the hydraulic valve bank reversing hydraulic flow to each cylinder independently. The actual reverse point is set to occur just before the cylinders reach their maximum extension or retraction. This setting can be changed if needed.

4.1 MAINTENANCE

Bearings

Bearings support various pulleys and require comparatively infrequent greasing. The tail pulley, head pulley and hold down rollers on the conveyor have bearings. These pulleys and rollers are supported by bearings. There are grease zerks on each bearing. The bearing manufacturer recommends use of lithium grease.

Frequency of greasing bearings depends upon RPM, hours of use and bearing type. See section 8.1 PPI Operation and Maintenance and greasing recommendations information for the Dodge Uni-Sphere II and the PPI SAF bearings.

Bearings located on the Exit assembly: Refer to section 8.1 for DODGE UNI-SPHERE II- Greasing information.

Head pulley and Tail pulley bearings:

Refer to section 8.1 PPI Operation and Maintenance and Greasing recommendations information.

Gear Reducers

Refer to Section 8.1 K-Series Service and Repair Instructions information for proper Volume and Frequency information.

Belt

The operational life of the conveyor belt is in large part dependent upon maintaining proper tensioning and alignment. During normal maintenance cycles and through observation during operation of the machine the tension and alignment of the main conveyor belt should be noted.

Loosening or tightening at the tail pulley accomplishes adjustment of alignment and tension on the conveyor belt.

The belt is joined with Flexco R5-Rivot stainless steel fasteners. These fasteners should be observed periodically to determine their rate of wear. This will help anticipate the rate of wear on the belt.

If desired the conveyor belt can be vulcanized by simply removing return rollers closest to the return point of the belt before it enters the machine and by loosening the belt at the tail pulley.

Wipers

A primary wiper for cleaning the conveyor belt is located at the head pulley (Figure 12). The wiper blade should be replaced when it is worn.

Wiper material is in place where the conveyor belt crosses and leaves the deck of the machine. Mounting points for the wipers are hinged. Replace this wiper material when it is worn.

Hydraulic Cylinders

There are six (6) hydraulic cylinders with one each at each corner of the machine and two on the support legs of the conveyor. Care should be taken to be sure the hydraulic lines remain in the brackets or holders that have been provided.

Hydraulic fittings should be regularly inspected for leakage and tightened when necessary. Observation should note any wear of the hydraulic lines.

Hydraulic Fluid/Filter

Hydraulic oil should be maintained at a level between the top and bottom ranges of the sight gauge on the hydraulic tank. This should be checked every day with the machine in normal operating position. Use Chevron Rando-HD ISO 32 or equivalent hydraulic fluid. The capacity of the tank is about 350 gallons. Return oil filters should be replaced after the first 100 hours. Then the filters should be changed when pressure differential indicates it on the return filter sight gauge.

5.1 Parts.

ASGCO	M-EZSK-SYS-60-EZT-54	1
	ASG-TTFRHD-150 - SELF ALIGNING RETURN ROLLER	1
BELT SERVICE	1/2" X 6" SKIRT BOARD RUBBER - 50 FEET LONG	1
	1/4" X 4" SKIRT BOARD RUBBER - 100 FEET LONG	1
BITTERMAN SCALES	091000 - WEIGH SHARK 500 BELT SCALE	1
DYKMAN	KT127/TDVE250M4/RS/TH	1
KIMBALL	15001- 1 1/2" END STAND BRACKETS	34
	D5-20TE-60SB	2
	D5-F-60SB, FLAT CARRIER	17
	D5-R-60SB	5
	RG60A- RETURN ROLLER GUARDS	8
	D5-35TE-60SB	6
	D5-35TESA-60SBL4	2
	DLFF64XT70ASSY/C DRUM STD DUTY COMB LAG 18 X 64 FLAT W/XT70 ASSY - 18 X 64 FLAT DRUM, WITH COMBI LAG AND XT 70 BUSHINGS. 7.00 X 142.00 SHAFT, TURNED AND GRINDED TO SPECS, TWO SAF 22534 5-15/16 IN 4-BOLT PILLOW BLOCKS.	1
	D12.75FF64XT50ASSY-DRUM STD DUTY 12 3/4 X 64 FLAT XT50 HUBS COMP ASSY. - 12.75 X 64 FLAT DRUM, WITH XT 50 BUSHINGS. 4 15/16 X 85.25 SHAFT, TURNED AND GRINDED TO SPECS, TWO (2) SAF 22526 4-7/16 IN PILLOW BLOCKS, TWO (2) SAF 526A END COVERS (LESS TAKE UP FRAMES)	1
	PHD-400X24 - PHD-400 X 24 TAKE-UP FRAME DRILL TEMP-4H474BHK78	2
	D END CLIP - 47117	100
MOTION INDUSTRIES	P2BUN2115E	1
	P2BUN2115	1
	P2BUN2215	2

	P2BUN2215E	2
RUBBER AND PLASTIC	60" WIDE 330 3PLY, 3/16 TOP, 1/16 BOTTOM 124'-0" LONG	1
SUNSOURCE	JK30A-2 - HYDRAULIC POWER UNIT	1
	AH0000624S - DAMAN HEADER BLOCK	2
	CVA-8376 DANFOSS PVG VALVE ASSY - 3 SECTION	2
	662517 CUSTOM ACTUATOR CYLINDER 4.5X36X3 XBE LRT	6
	662517 CUSTOM ACTUATOR CYLINDER 5X24X2.5 XBE LRT	5
	PR3150 PLUS 1 CONTROL PACKAGE	1
	CVA-8557 DANFOSS PVG32 VALVE ASSY - 5 SECTION	1
	157B9402 - DANFOSS PVBZ SPOOL 10.6 PVG100/32	1
	SA-5367-MA - UNLIMITED WIRE HARNESS	1
	BHR100-CABLE KIT	2
	1704-C-1 KEPNER #4JICXMJIC CHECK	3
	SMS20-N1/4-610-B - STAUFF 24" TEST HOSE	1
	SMK20-JIC1/4-VK-C6F - CARBON STEEL TEST POINT	10
	SMK20-JIC3/8-VK-C6F - CARBON STEEL TEST POINT	14
	SMD20-1/4NPT-C6F - STAUFF TEST COUPLER	1
	SPG-063-05000-5-SN04 - STAUFF GAUGE	2

Electrical Parts (others)

Ashross 480volt AR-RUMig-822

Part	Part Number	Quan
Control box 60x72x24	HOF A-74H6018LP3PT	1
Back panel	HOF A-72P60	1
75 hp VFD	AB 20F1AND96AA0NNNNN	1
Remote HIM	AB 20-HIM-C3S	1
HIM ext. cable	AB 1202-H30	1
Ethernet comm. card	AB 20-750-ENETR	1
100 hp pump contactor	AB 100-D180D11	3
Pump contactor lug kit	AB 100DTB180	4
100/75 hp pump/belt overload	AB 193-EEHF	4
Cool. fan/heater contactor	AB 100-C12D10	2

Cooling fan overload	AB 193-EECB	1
Panelview	AB 2711P-T7C4A8	1
PLC power supply	AB 1769-PA2	1
PLC processor	AB 1769-L30ER	1
PLC input card	AB 1769-IQ16	3
PLC analog in card	AB 1769-IF8	1
PLC output card	AB 1769-OW16	1
PLC right end cap	AB 1769-ECR	1
Surge suppressor	AB 4983-DC120-05	1
Control transformer	ACME T-2-53012-S	1
24 V power supply	SOL SDN 10-24-100P	1
Relay 120 V	AB 700-HA32A1	17
Relay socket 8p	AB 700-HN125	17
Indicator light (power/fault)	AB 800T-QH2W	3
Amber lense	AB 800T-N26A	1
Red lense	AB 800T-N26R	2
E- stop button	AB 800T-FX6D4	2
E- stop tag	AB 800T-646EM	2
NC contact block	AB 800T-XD2	2
Flush green PB	AB 800T-A1D1	2
Ext. red PB	AB 800T-B6D2	3
Flush black PB	AB 800T-A2D1	2
3 pos. spring selector	AB 800T-J91A	1
Alarm horn	FED 450E-024	2
Box	FED WB	2
Strobe light	FED FB2PST-I-024A	2
Ground terminal #10	AB 1492-JG4	10
Terminal #10	AB 1492-J4	200
Terminal keeper	AB 1492-EAJ35	5
Terminal end #10	AB 1492-EBJ3	25
Jumper	AB 1492-CJJ6-10	5
Terminal marker	AB 1492-EAJ35	5
4x3 wire duct	T&B TY4X3NPW6	6'
4" wire duct cover	T&B TY4CPW6	6'
3x3 wire duct	T&B TY3X3NPW6	6'
3" wire duct cover	T&B TY3CPW6	6'
2x3 wire duct	T&B TY2X3NPW6	24

2" wire duct cover	T&B TY2CPW6	24
1x3 wire duct	T&B TY1X3NPW6	6
1" wire duct cover	T&B TY1CPW6	6
PLC 36 x 36 box	HOF CSD363612	1
36 x 36 panel	HOF CP3636	1
Disc. 20 x 20 box	HOF CSD20208	2
20 x 20 panel	HOF CP2020	2
EC2,JB1 12 x 12 box	HOF CSD12126	2
12 x 12 panel	HOF CP1212	2
24 pin female insert	T&B FS124B	1
24 pin male insert	T&B MS224B	1
24 pin hood	T&B TH924MV	1
24 pin panel base	T&B PB324	1
16 pin female insert	T&B FS116B	2
16 pin male insert	T&B MS216B	2
16 pin hood	T&B TH816MV	2
16 pin panel base	T&B PB316	2
Labels	PAN S50X75VAC	1
Labels	PAN S100X225VAC	1
Main ground lug	T&B ASL60-42	1
Ground lugs 1 hole #1	T&B ADR11	5
Ground lugs 2 hole #1	T&B ADR11-21	6
#1 3/8 short crimp lug	T&B 54148	25
100hp 225 amp breaker	AD F3-P225	3
75hp 225 amp breaker	AD K3-P400	1
Fan/heat breaker	AD WMZS3D10	4
2 pole breaker transformer	AD WMZS2D10	1
1 pole breaker control	AD WMZS1D15	1
E-net switch	AD SE-SW5U	1
200 amp CT	AD ACT200-42L-F	4
Red ferrule	AD BM-00504	1
Yellow ferrule	AD BM-00503	1
Safety pull switch	CCC RSB-2	4
Mis-alignment switches	CCC TA-2	2
Cooling fan 8"	PFA 11632154055	1
Filter kit 8"	PFA 11730004055	1
Main disconnect 800A	ABB OT800U03	1

Lug kit	ABB	OZXA-1200	1
Handle kit	ABB	OHB200J12P	1
Handle shaft .47	ABB	OXP12X535	1
Motor disconnect 200A	ABB	OT200U03	2
Handle kit	ABB	OHB80L6	1
Handle shaft .24	ABB	OXP6X210	1

See Section 6.1, "Drawings", for a listing of certain electrical parts mostly associated with the electrical control panel.

6.1 Drawings

7.1 Electrical Schematics/Hydraulic Schematics

8.1 Vendor Manuals or References

Allen Bradley variable frequency drive (VFD) manuals were shipped with the electrical control panel along with electrical schematics. Access to the manuals and additional information can be secured at the following internet site of Allen Bradley: http://literature.rockwellautomation.com/idc/groups/literature/documents/td/750-td001_-en-p.pdf

Note that the variable frequency drives are:
ALLEN-BRADLEY POWERFLEX 750 Series
PN: 20F1AND186AN0NNNNN

9.1 Supplemental/Subsequent Information