APPENDIX A: Miscellaneous Operating Procedure for the Transportable Gasifier for Animal Carcasses

Appendix A

Miscellaneous Operating Procedure for the Transportable Gasifier for Animal Carcasses

Prepared for

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1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the operation of the Transportable Gasifier for Animal Carcasses (gasifier) modified for the U.S. Environmental Protection Agency's (EPA) National Homeland Security Research Center's (NHSRC) Decontamination and Consequence Management Division (DCMD). In April 2013, ARCADIS was awarded a contract to make repairs and modifications to the gasification system as part of a comprehensive response strategy to effectively mitigate animal health emergencies (i.e., high–consequence foreign animal diseases) and maintain continuity of business to the maximum extent practicable. The focus of this project was confined to the accomplishment of a minimum throughput of 25 tons of carcass material per day over a three day period and the identification of challenges, opportunities, and advances that relate to the technology. This response strategy must incorporate plans and technologies for rapid depopulation, decontamination, and disposal of affected animals. This technology could be used as a disposal option for animal carcasses following a disease outbreak.

Major components of the gasifier system include a pre-breaker, finer, accumulator, feed augers, drag chain conveyors in each gasifier chamber, ash auger, exhaust stack, and multiple pumps. Liquefied petroleum (LP) gas burners are used to heat the chambers and a diesel fueled generator is used to power the remainder of the system components and control system. The gasifier control system is operated by two programmable automation controllers (PACs) connected to a personal computer (PC)-based Supervisory Control and Data Acquisition (SCADA) system.

This SOP references instrument identification defined in the Transportable Gasifier Control electrical schematics. A copy of these electrical schematics can be found in Appendix B.

2.0 SUMMARY OF METHOD

The gasifier currently resides in Rose Hill, NC and is shown in Figures 1, 2 and 3. The blue diesel generator can be seen beside the gasifier.

Figure 1. Front View of Gasifier and Diesel Generator

Figure 2. Opposing Side View of Gasifier

It was determined that a larger macerator or grinder would be necessary to effectively and efficiently grind the larger bovine and equine carcasses that may be processed in the future. This was accomplished by the incorporation of a pre-breaker (Figure 4) and associated infrastructure and transporting systems. The screw, seen on the far right of Figure 4, moves material to the feed pump (Figure 5) which transports the material to a finer (Figure 6). The finer further reduces the size of the ground animal parts to ≤ ¾" size.

Figure 3. Rear View of Gasifier

Figure 4. Pre-Breaker and Screw

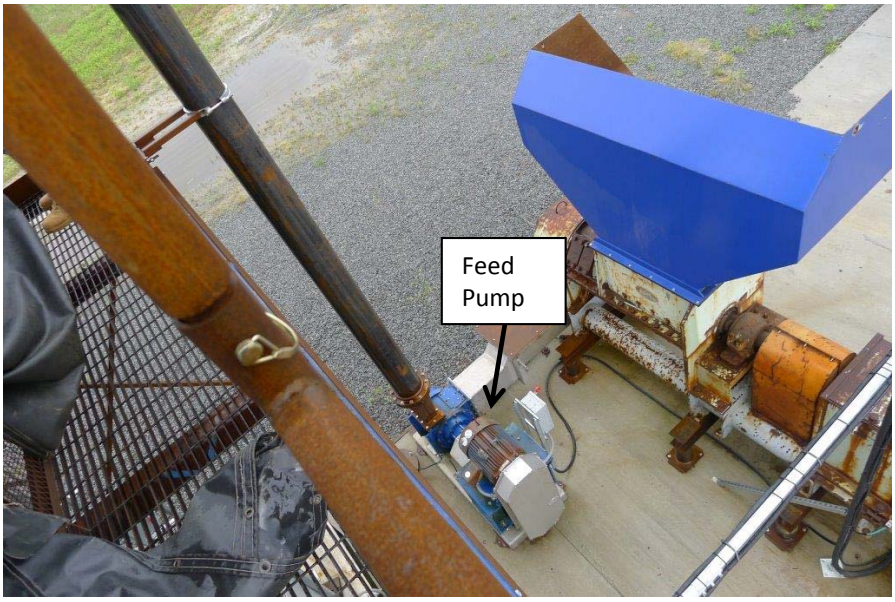


Figure 5. Feed Pump

Figure 6. Finer

The reduced animal parts are dispensed from the finer, through an extrusion plate with holes, and into an accumulator (Figure 7), which serves as an intermittent holding bin for the gasifier feed stock.

Figure 7. Accumulator

The fully ground material is then conveyed by two bin screws that are mounted within the bottom of the accumulator (Figure 8). At approximately the midpoint of the bin screws, the pipe diameter is decreased slightly to force a full capacity pipe. Temperature elements (thermocouples) monitor the temperature at these locations for possible flashback from the gasifier chambers.

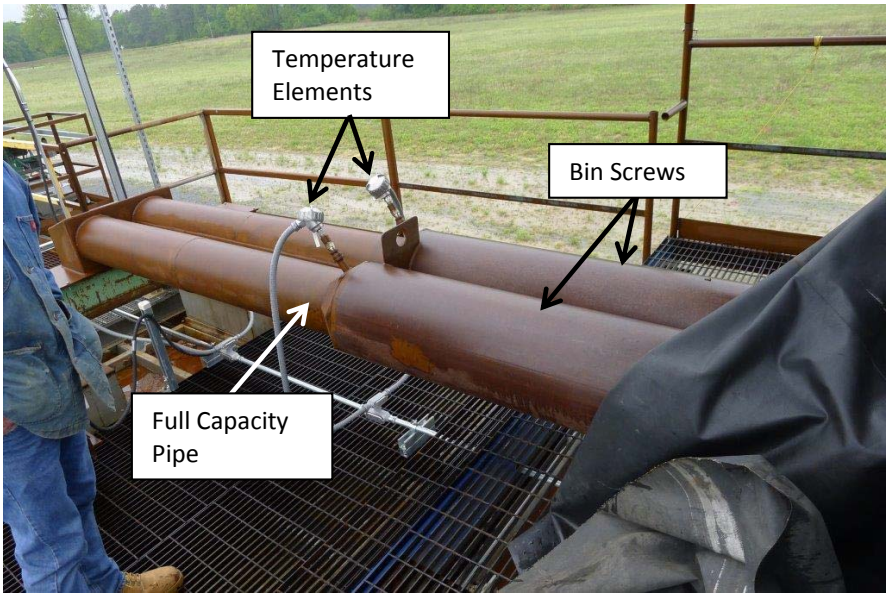


Figure 8. Bin Screws

The bin screws terminate in a box that has a screw with opposing flights (Figure 9), so that material is fed into the gate valve for each opposing chamber (Figure 10).

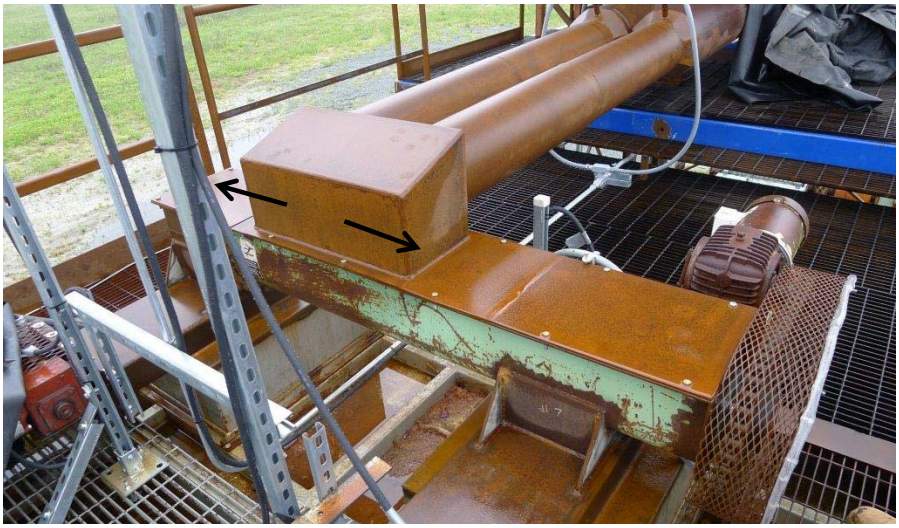


Figure 9. Screw with Opposing Flights to Gate Valves

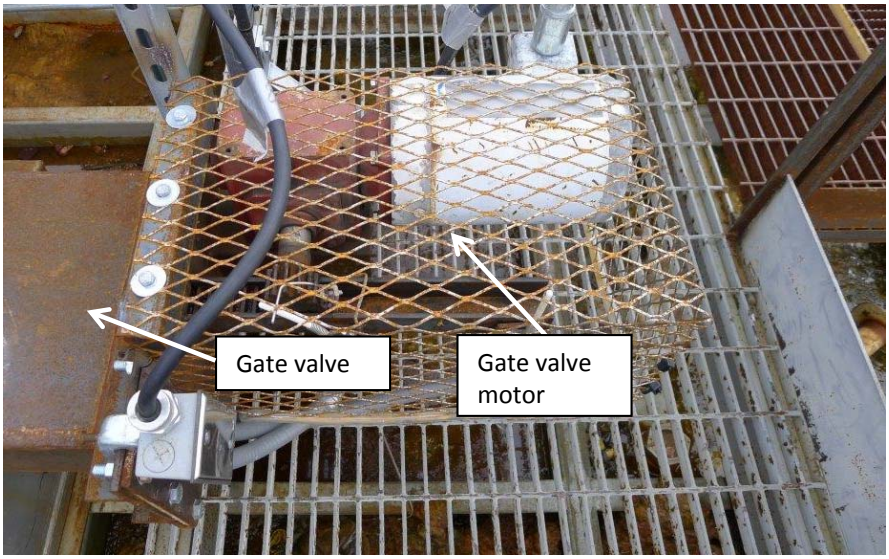


Figure 10. Gate Valve to Gasifier

The two gate valves allow material to drop into each gasifier chamber (Figure 11). A drag chain conveyor travelling approximately 1 foot/20 minutes in each primary chamber is used to distribute the feed material across the hearth. The hearth of each primary chamber is heated from below by a 2.15 MM

Btu/hr vertical down-fired LP gas burner (Figure 12). The ash auger conveys the remaining ash and bone out of the chamber as it accumulates.

Figure 11. Gasifier Chamber showing Drag Chain and Ash Auger

Figure 12. LP Burners and Exhaust Stack

2.1 SCADA System Operation

The Supervisory Control and Data Acquisition (SCADA) system provides the human-machine interface (HMI) with the gasifier's temperature, calibration, burner control, and feed control systems. As well as providing the HMI, the SCADA system logs to disk the system temperatures with timestamps for later retrieval and analysis. Alarm handling and recording is also built into the HMI package of the SCADA system.

The gasifier system uses two programmable automation controllers (PACs). One is installed in the power distribution panel and the other is in the main control panel. The power panel PAC is primarily responsible for controlling the pre-breaker, finer, and feed system components. A second PAC is installed in the main control panel. This PAC interfaces with the two burner management systems (BMS) and also monitors the many thermocouples installed in the system. The two PACs are connected to the SCADA computer by way of an Ethernet switch installed in the main control panel.

3.0 DEFINITIONS/ACRONYMS

°C	Degrees Celsius
°F	Degrees Fahrenheit
BMS	Burner Management System
CMC	Combination Motor Controller
CR	Control Relay
CSV	Comma Separated Values
DCMD	Decontamination and Consequence Management Division
EPA	Environmental Protection Agency
HMI	Human-machine interface
LP	Liquefied petroleum
mA	Milliamps
MC	Motor Controller
NHSRC	National Homeland Security Research Center
O&M	Operations and Maintenance
PAC	Programmable Automation Controller
PC	Personal Computer
PID	Proportional Integral Derivative
QA	Quality Assurance
SC	Speed Controlled (Variable Frequency Drive [VFD])
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
SS	Soft Starter
TE	Temperature Element (Thermocouple or Resistance Temperature Detector)
TIC	Temperature Indicating Controller
UPS	Uninterruptible Power Supply

4.0 CAUTIONS

4.1 LP and diesel fuel

4.2 Moving parts (blowers, pre-breaker, pumps, shafts, pulleys, etc.)

4.3 Electrical hazards (control panels, blowers, pumps, generator connections, etc.)

4.4 Slip/trip/fall hazards accessing generator, electrical panels, mezzanine, and machinery

4.5 Heat hazards from gasifier high temperatures at stack, gasifier surfaces, and mezzanine level surfaces and equipment

5.0 APPARATUS AND MATERIALS

5.1 Apparatus

Gasifier and associated grinding and feed system.

Portable 250 kVA, 277/480 volt, 3 phase diesel generator with patch panel.

Dell SCADA laptop computer.

Custom ARCADIS control and power distribution panels with Opto 22 process control hardware.

Opto 22 PAC Project software suite for control logic programming and SCADA configuration.

5.2 Supplies

The SCADA system is virtually maintenance free. For maintenance of the control system hardware, check the Gasifier Control System Operations and Maintenance (O&M) Manual for additional information.

6.0 SYSTEM SETUP

6.1 Start the generator.

1. Check that sufficient diesel fuel is available for planned operations. Insert a dip stick through the fill cap located on the inside of the first door, on the left side from the rear of the generator. The generator holds approximately 300 gallons of fuel.
2. Connect, and secure by turning ¼ turn, the flexible cables from the generator to the docking station (Figure 13) on the back of the power distribution panel.

Figure 13. Generator Docking Station

3. Turn the key on the battery isolation switch to connect the battery to the generator so that it can be started (Figure 14). This will start an alarm on the generator control panel.

Figure 14. Connect Battery in Preparation for Starting Generator

4. Turn off the alarm by pressing the alarm silence button, then press the green RUN button to start the generator (Figure 15). Additional generator operating and

maintenance information can be found in the Caterpillar Operation and Maintenance Manual (Reference 3).

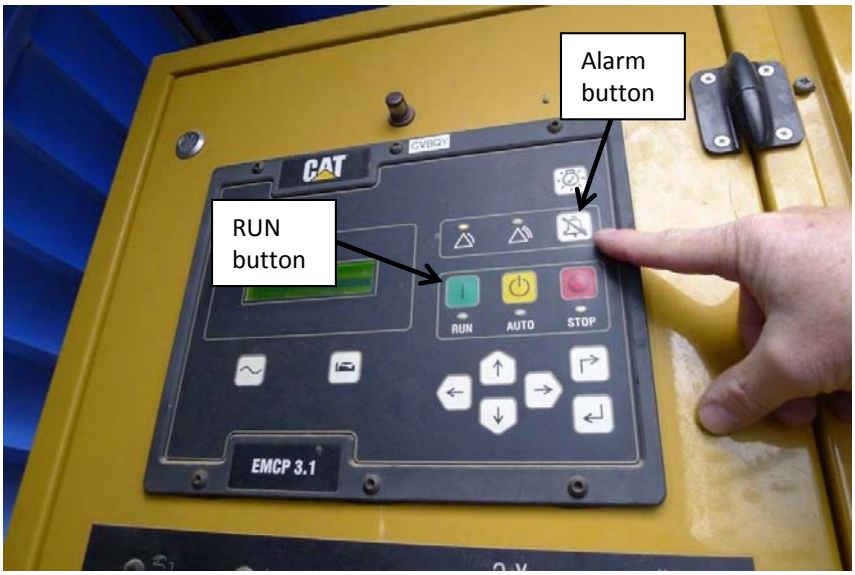


Figure 15. Alarm and Run Buttons on Generator Control Panel

6.2 Switch power to systems.

1. Turn main disconnect switch located at the top right of the power distribution panel ON (Figures 16a and 16b) by pushing it upward. This panel provides power for all of the gasifier electric panels and accessories. See drawing number E-2.3 for identification of all hardware.

Figure 16a. Outside of Power Distribution Panel

Figure 16b. Inside of Power Distribution Panel

2. Turn POWER switch on left side of left front door **ON** (Figure 17). This turns on power to the control hardware located in the power distribution panel and the white power light should light up as well as other indicator lights on the left door panel.

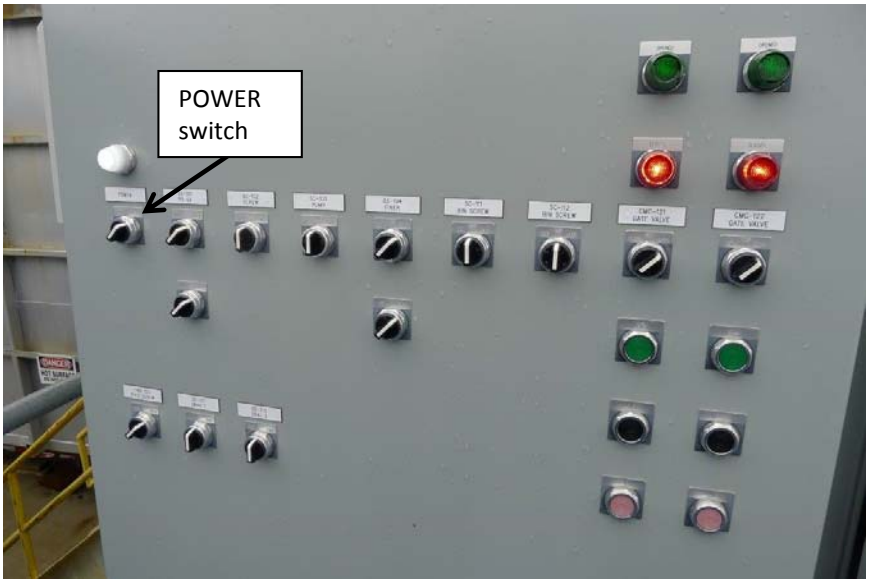
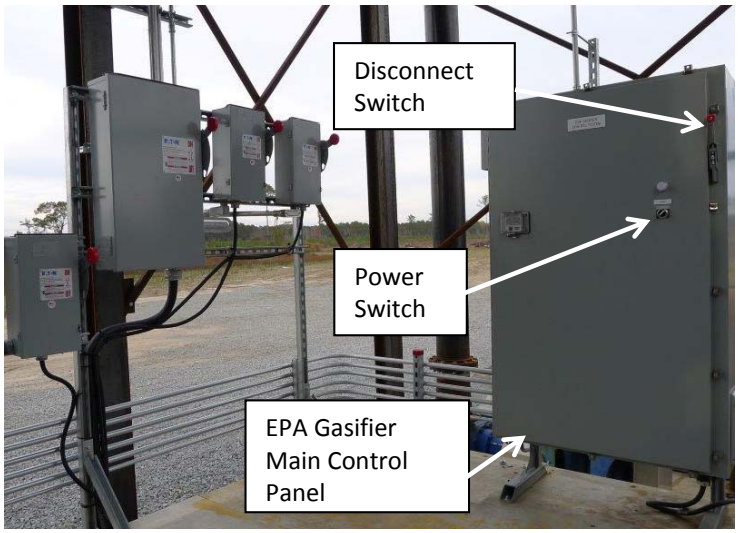


Figure 17. Power Switch on front of Power Distribution Panel

3. Open door on EPA Gasifier Control System panel and turn the UPS **ON** (Figure 18; location in panel shown in Figure 19). Close the door. The control hardware is powered by the UPS and will not come on if the UPS is not enabled. The main control panel interfaces with the Blower Management System (BMS), thermocouples, combustion air, and blower motor starters. See drawing number E-3.1 (Appendix B) for identification of hardware inside the main control panel.

Figure 18. UPS Control Panel

4. Close cabinet door and turn disconnect switch on main control panel **ON** (shown in Figure 19).
5. Turn power switch on front door of control panel **ON** (Figure 20). White indicator light should light up indicating that panel is energized. This switches power to the control hardware.
6. To enable remote connection/operation, connect extension cord and CAT 5 cable to receptacle and connector location on left side of front door of Control Panel. Place wireless internet receiver in a water resistant container at a safe location and as high as possible on the mezzanine level.

a) 

b) 

Figure 19. EPA Gasifier Control Panel, outside (a) and inside (b)

Figure 20. Power Switch on EPA Gasifier Control Panel

6.3 Enable field devices.

Confirm all local motor disconnects are in the up or **ON** position.

6.4 Complete startup through SCADA system PAC interface.

1. Connect all computer accessories and Ethernet cable, then power up computer.
2 Set large monitor as the primary display in Windows.
3. Click on Start and select PAC Display which will open to the Home Screen (see Figure 22). Using mouse, drag and drop this window from the laptop to the large screen monitor. The following navigation buttons are located across the bottom of the screen. Their function is detailed in Section 8.
    a) Go To Feed Sys Screen (under development)
    b) Go To Burner Screen (see Figure 23)
    c) Go To Temperature Screen (see Figure 24)
    d) Go To Motor Ctrl Screen (see Figure 25)
    e) Go To Alarm Screen (see Figure 26)
    f) Go To Calibration Screen (see Figure 27)

4. Go to the Motor Ctrl screen (Figure 25). Click the **Forward** Drag Chain buttons at callout C located under the tags labeled SC-211 and SC-212 for gasifier sides 1 and 2, respectively. The buttons will change from displaying **OFF** to a filled green **FW** status, and the **Running** lights should also illuminate at callout E for SC-211 and SC-212. Click the **Forward** buttons once more to stop the drag chains.

   The motors can be reversed by employing the same procedure by using the **Reverse** buttons at callout D under tags SC-211 and SC-212.

5. Motor speed can be changed by entering a percentage of full speed in the **Freq SP Opto** box at callout G. These motors will not go below 11 Hz out of a possible 60 Hz.

6. Before starting the burners, make sure the LP gas supply is on and a sufficient quantity is available in the tanks for planned operations.

7. **DO NOT** ADJUST THE SMALL VALVE TO THE PILOT. The flame rod will lose sight of the pilot flame if it is too rich.

8. Go to the Alarm Screen (Figure 26) and verify that there are no active alarms. Reset any alarms present by selecting the **Reset** button at callout E.

9. Go to the Burner Screen (Figure 23) and “enable" the burners by clicking on the buttons next to **Burner 1** and **Burner 2** at callouts N and R, respectively. This will start the flame safety sequence including a purge time, pilot trial for ignition time, and enabling of the main gas valves if successful. Yellow flames will start flashing on the screen when a flame is present and temperatures will start rising.

   If a burner doesn’t start after the trial for ignition period or the flame goes out for any reason, a **BMS Alarm** will be indicated at callout P of Figure 23. To attempt a restart, "disable" the burner by clicking the button at callout N. Wait a few seconds and enable the burner again as described at the start of Step 9.

   If a burner fails to light repeatedly, it may be necessary to manually reset the solenoid valves on the gas lines by firmly pushing the indicator light on the front of the solenoid (Figure 21).

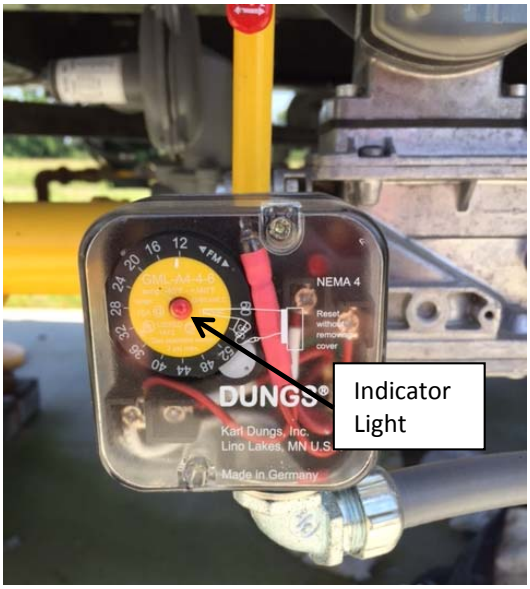


Figure 21. Gas Line Solenoid Valve Reset

10. To control the gasifier to a specified temperature, enter a target set point at callout D of Figure 23. It is recommended to ramp up the temperatures slowly to confirm the operation of the temperature control system before advancing to the final target. Confirm the Proportional Integral Derivative (PID) loops are in "auto" mode. They can be toggled between "man" (manual) and "auto" using the button at callout F.
11. While the unit is warming up, walk around the gasifier and look for hotspots on the skin and confirm the proper operation of the other devices in the system. The area around the burners can get quite hot. A glowing red area would indicate an insulation failure.

7.0 METHOD CALIBRATION

The environmental sensors in the gasifier system include the following:

- Eighteen thermocouples (plus six spare inputs) shown in Figure 24.
- Two level switches (bindicators) shown at callout K in Figure 25.

Sensors should be routinely calibrated by a capable metrology laboratory or other reference standard. The SCADA system applies linear correction curves to the raw transmitter inputs. The corrected values are used for display and calculations, and the results are logged for later retrieval and analysis. See Section 8.6 for additional information on the calibration procedure.

8.0 SYSTEM OPERATION

The SCADA system provides the main interface with the gasifier control system. The graphical interface allows the user to enter set points, review historical data, view alarm conditions, and interface with the process control hardware. There are seven screens:

1. Home Screen
2. Feed System Screen (under development and not addressed in this SOP)
3. Burner Screen
4. Temperature Screen
5. Motor Control Screen
6. Alarm Screen
7. Calibration Screen

The graphs shown on many of the PAC Display screens display historical data for review by the operator and provide a quick check for anomalies. The display characteristics of the graph can be changed using the icons located below the graph's window. The active variable can be chosen using the drop-down arrow below the graph. By clicking on the magnifying glass, the y-scale for the active variable can be changed. Historical data that has been shifted off the real-time graph can be displayed by clicking the folder icon and selecting the appropriate day. The arrows can then be used to page through time. To return to real time, simply click the clock icon. Additional information about the graphing features and options can be found in Opto 22's PAC Display Manual (Reference 1).

The operation of the system will be described screen-by-screen starting with the Home Screen. For each screen, the user interface will be described, as well as general information about the physical devices that are manipulated in the control strategy as they relate to the screen. Note that any number or "button" with a yellow outline represents a user-settable number or condition. Yellow outlined buttons are also used to enable devices and for navigation between the screens.

8.1 Home Screen

The Home Screen is shown in Figure 22. The Home Screen allows quick access to all of the screens as well as providing a graphic of the system flow and instrumentation. From this screen, the operator can navigate to any of the other screens using the buttons identified by callouts A through E.

Callout	Screen
A	Burner
B	Temperature
C	Motor Control
D	Alarm
E	Calibration

The Power Monitor Reset buttons, identified by callout F in Figure 22, are used to latch a relay inside the control panel. This relay opens if there is a failure in the power supplied to the control panel. The opening of this relay alerts the operator (see Alarm Screen, Figure 26) and control system that a power failure has occurred. If the Power Monitor light is green, nothing needs to be done. If it is flashing red, then the relay has opened and should be reset by selecting the "Reset" button. Note that this relay will not unlatch when the power switch on the panel is cycled. A Power Monitor light flashing red does not necessarily mean that there is presently no power to the control panel, but that a power failure has occurred since the last "reset". If the Power Monitor light does not go to green after selecting "reset", then the outage is still in effect. The status of the relay can be observed by looking at the indicator status on control relay CR-1 inside the main control panel.

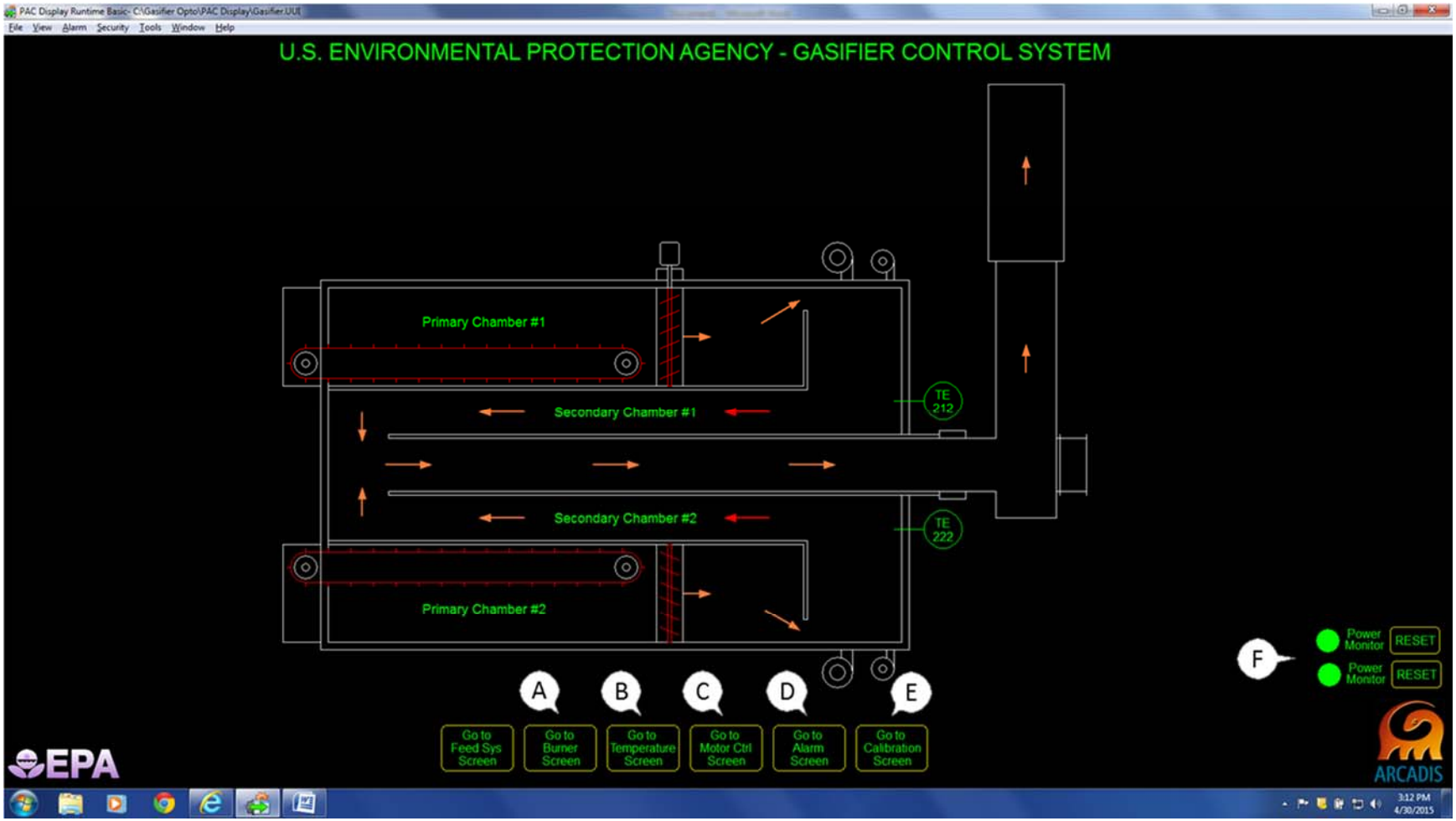


Figure 22. Home Screen

8.2 Burner Screen

The Burner Screen shown in Figure 23 allows the operator to "enable" the burners and to control and monitor the burners and temperature set points in each gasifier chamber.

The buttons located at callout A are used to enable the burners for each chamber. Burners 1 and 2 can also be "enabled" by clicking on the buttons at callouts N and R, respectively. This will start the flame safety sequence including a purge time and pilot trial for ignition time, and will then enable the main gas valves if the pilot was successful. Yellow flames will start flashing on the screen when a flame is present and temperatures will start rising. If a burner doesn't start after the trial for ignition period or the flame goes out for any reason, a **BMS Alarm** will be indicated at callout P. Callout O indicates when the burner combustion air blower has been enabled; callout Q is clicked to toggle the secondary air blower and is typically not used. **Note:** Callout Q should be disabled and the disconnects at the secondary air blowers locked out because they have been blocked with refractory material.

Callouts L and M on the Burner Screen can be used to toggle the drag chains on and off. Drag chain control can also be accessed through the Motor Ctrl screen (Figure 25) where the speed and direction of the chain can be modified.

The buttons located at callout B indicate the thermocouple providing the PV Input for each chamber. Each chamber has two control thermocouple choices: one in the primary chamber (TE-212 and TE-222 for chambers #1 and #2, respectively), and one located at the end of the secondary chamber under each hearth (TE-213 and TE-223 for chambers #1 and #2, respectively). Clicking on the buttons at callout B will toggle between the two options. Due to the indirect heating of the chamber area, it was found that controlling to the secondary temperature was more responsive and provided a much more responsive feedback control loop. This condition may change once carcass material is introduced into the primary chambers.

Callout C shows the current process variables, while the target set points are shown at and can be adjusted at callout D. The button at callout F allows the operator to switch the PID calculation to manual. In manual mode, the output value does not automatically adjust, and the operator can manually control the burner output by entering a percent output value at callout E.

The P, I, and D parameters located at callout G are involved in the PID calculation. The PID algorithm adjusts the PID Output value to align the process variable with the target set point. Adjusting these parameters (P, I and D) will “tune” the PID loop and can be used to reduce the response time or increase the stability of the process. Typically these values should not be changed. If the operator wishes to change these values, they should record the current values for later reference in the event that the loop becomes unstable.

“Max dOut” at callout H will set an upper limit on the allowable output change by the PID calculation. The “Input Low Clamp” and “Input High Clamp” at callout I are basic limits on the input values (temperatures) feeding into the PID algorithm. “Output Hi Clamp” at callout J will limit the maximum output of the burner. For example, it may be advantageous to limit the “Output Hi Clamp” of the burner to 85 percent to prevent overheating. “Scan Time” at callout K determines how often the PID algorithm is run in seconds. None of these tuning parameters will typically need to be modified unless there are significant physical changes to the system.

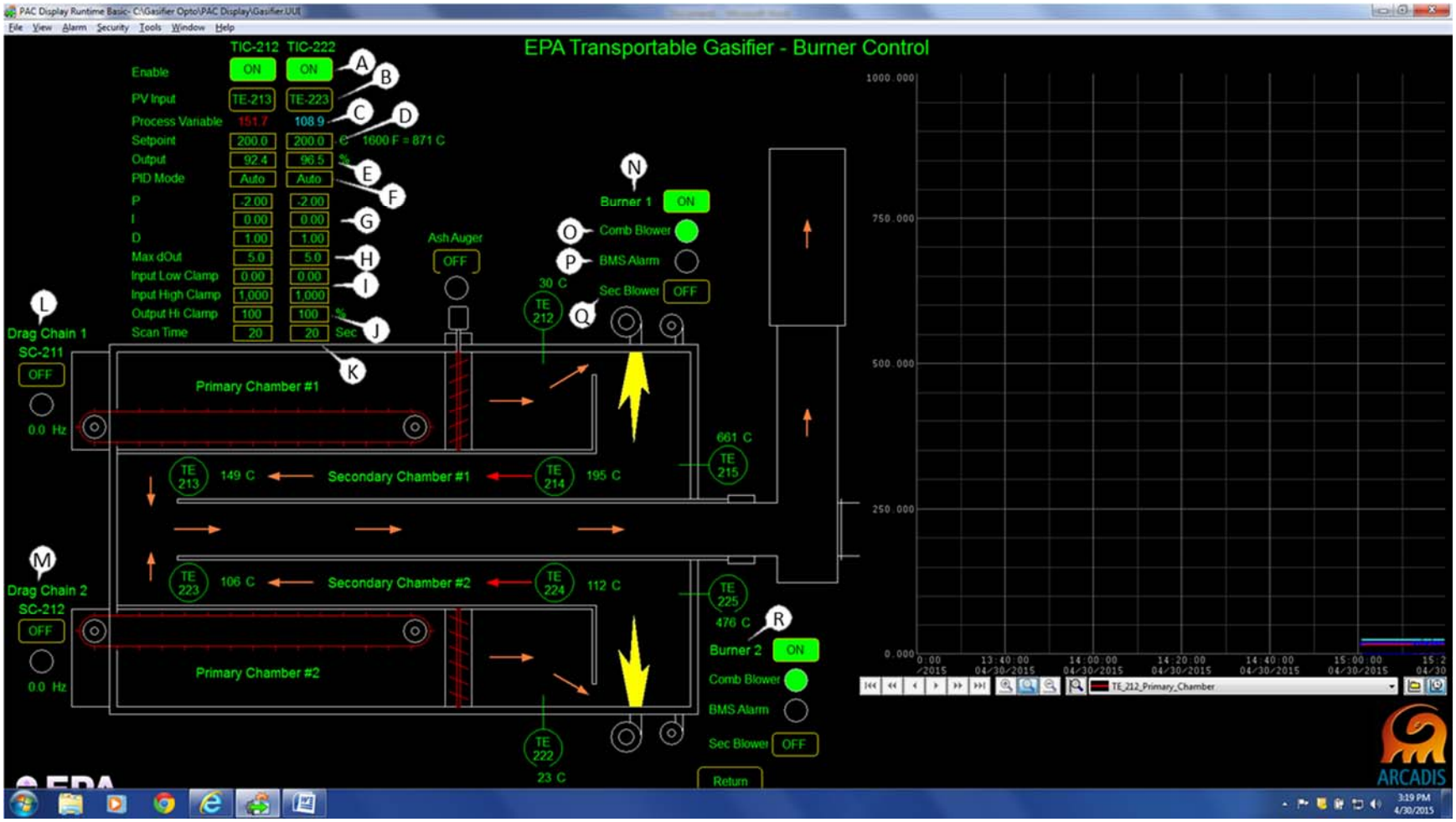


Figure 23. Burner Screen

8.3 Temperature Screen

The temperature screen is shown in Figure 24. This screen shows all of the measured temperatures in the gasifier as well as a graphic of their general location. The bin screw temperatures are also shown on this screen. These are used to monitor for flashback into the feed screws and shut the system down if the temperatures exceed certain values.

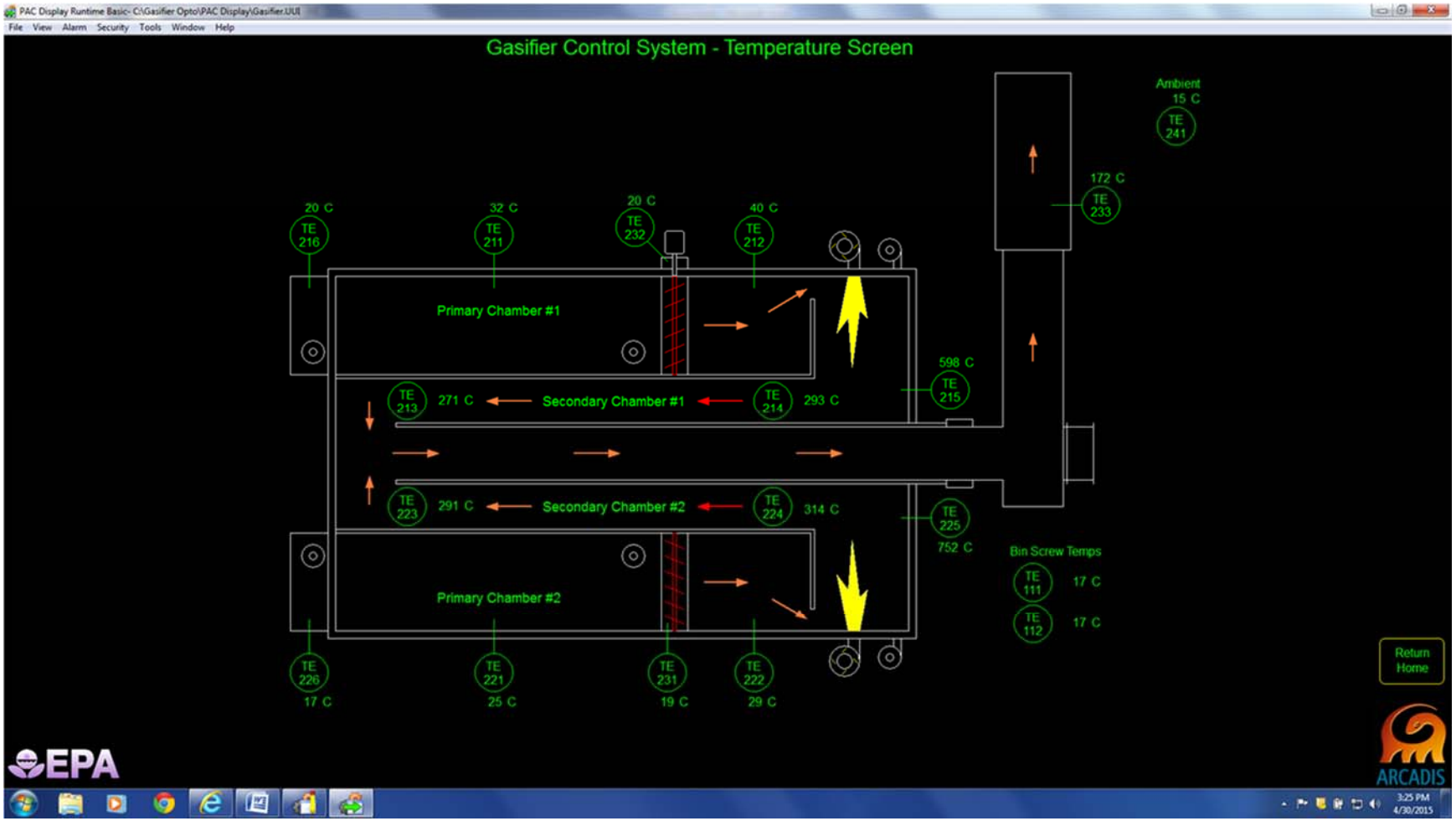


Figure 24. Temperature Screen

8.4 Motor Control Screen

The Motor Control Screen is shown in Figure 25. This screen allows the operator to control all of the motors in the system and view the operational status of the motor controllers. It also allows the operator to reset motor controller faults, open and close the feed valves, and shows the status of the bindicator level switches.

In the top left of the screen are the six speed controllers (variable frequency drives) identified by the tags to the left of callout A. The motors can be controlled from the computer interface or manually from the front of the power panel. The system defaults to computer control, however each motor can be switched to manual control by toggling the button to the left of callout B. This switches between “Modbus” and “Teminal” mode. In “Modbus” mode, the motor is controlled by the power distribution PAC via the RS-485 Modbus network. In the “Terminal” mode, the motor is controlled by the screw terminals on the variable frequency drive that are connected to switches mounted on the front of the power distribution panel.

Forward and reverse operation of each motor is allowed by toggling the buttons at callouts C and D. The motor should be toggled off before reversing the direction. The status of the drive is shown to the left of callout E. When the drive status is filled solid green, the drive is ready. When the drive is running in either the forward or reverse direction, the running indicator to the left of callout F is filled green. Faults are indicated to the left of callout G by a flashing red button. The frequency set point in percent is entered at the left of callout H. 100% corresponds to the maximum speed or frequency of 60 Hz. Note that the minimum drive speed is 11 Hz or approximately 18% of full speed. Operational details are provided to the left of callout I, including the frequency set point, actual frequency, motor current, and the last fault code stored in the drive. Drive faults can usually be reset by pressing the “reset faults” button to the left of callout J. If the fault does not clear, note the drive fault code and refer to the appropriate drive manual.

Below the speed controllers are the controls for the soft starters SS-101 and SS-104. The soft starters are used to ramp the speed up on the pre-breaker and finer. The motors can be switched on using the buttons to the right of callout K. They can also be used to reverse the speed of each motor using the button to the left of callout L. The motor should be switched off prior to reversing direction. There are several status buttons to the left of callout M that indicate the operational status of the soft starter. The “Ready to switch on” and “Switched on” follow nomenclature in the starter manual and need to be filled green prior to enabling the motor. A problem with the starter is shown by

a flashing red button to the left of callout N. The motor current is displayed to the left of callout O. Starter faults can often be reset using the buttons to the left of callout P. If the fault does not clear, check the circuit breaker in the power panel, note the fault displayed on the front of the soft starter, and refer to the starter manual as needed.

The feed screw, ash auger, and the two combustion air blowers have basic on/off control. The feed screw and combustion air blowers are controlled with combination motor controllers and can be switched on and off using the buttons to the left of callout Q. The ash auger is a very small motor controlled by a relay (2-CR).

Slide gate valves 1 and 2 are controlled with reversing combination motor controllers. When the “open” button is selected at callout R, the motor runs until the open limit switch is triggered. Similarly, when the “closed” button is selected (callout S), the motor runs until the closed limit switch is triggered. The “stop” button at callout T will stop the motor, but it has little use since the valves open and close nearly instantaneously after pressing the open or close button. Both accumulator bin screws and the feed screw will be stopped if either slide gate valve is closed.

Also displayed on this screen at callout U is the status of the bindicators located in the accumulator hopper. If the “high” switch is met, the pump will be stopped to prevent overfilling the accumulator hopper. Similarly, the pump and pump feed screw will be started if the “low” switch is not met indicating a close to empty condition.

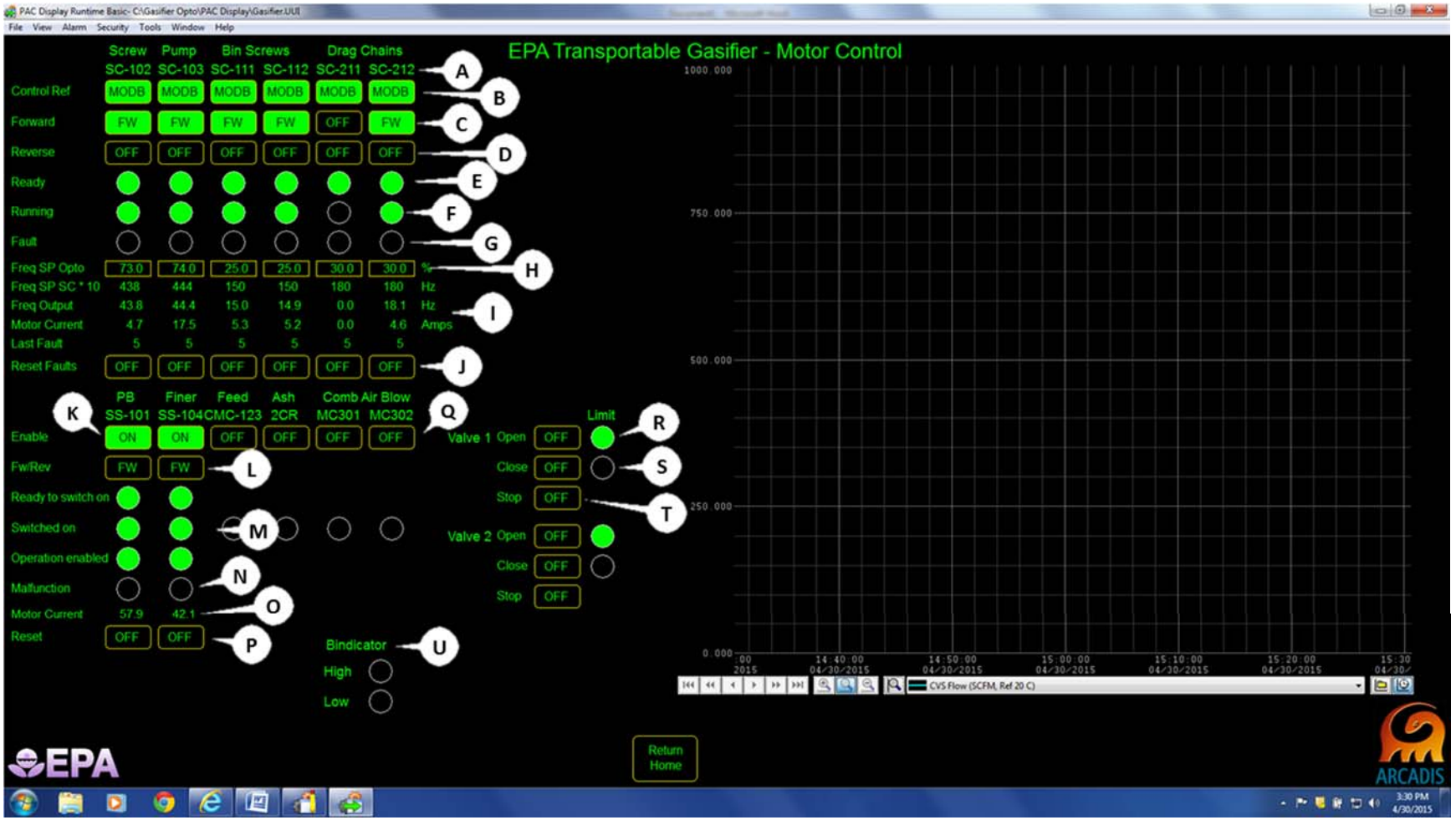


Figure 25. Motor Control Screen

8.5 Alarm Screen

The Alarm Screen is shown in Figure 26. This screen typically displays some of the most important process variables as well as any alarm conditions that may be present. The area above callout A displays the current process variable. If this is a controlled variable, the set point is displayed in the area above callout B. In the case of the gasifier temperature control system, these set points may correspond to primary or secondary chamber temperatures. See Section 8.2 describing the burner operation and temperature control for additional information on switching the control set points from the primary to the secondary chamber. The low and high alarm limits can be entered above callouts C and D, respectively. If an alarm condition is detected, the condition at the time of alarm will be stored in red under the “Trap” column. The alarm and the trapped conditions are cleared by pressing the “Reset” button at callout E.

While not shown explicitly on this screen, the power monitor alarm is configured and will be displayed in the alarm log above callout F. Alarms stored in the alarm log can be acknowledged using the “Acknowledge” and “Acknowledge All” buttons at callout G. Additional information on the operation of the alarm display log can be found in Opto 22’s PAC Display Manual (Reference 1).

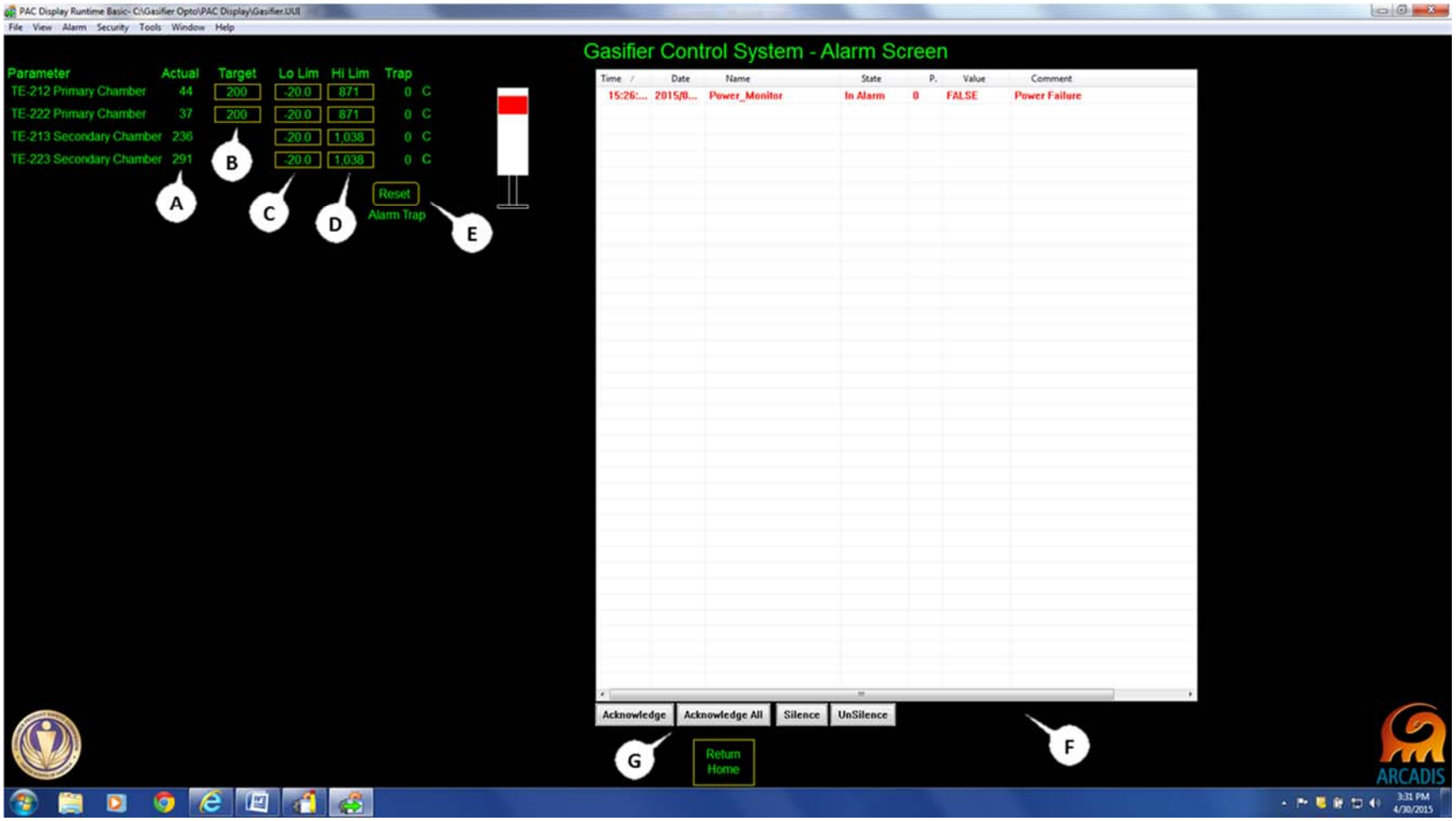


Figure 26. Alarm Screen

8.6 Calibration Screen

The Calibration Screen is shown in Figure 27. This screen displays calibration data for the thermocouples used in the system. The area above callout A displays the "raw" signal received by the main control panel. This may be a voltage, milliamps (mA), or an un-calibrated variable. In the area above callouts B and C, the operator can enter linear corrections (scale and offset values, $y = mx + b$) for each sensor. The values displayed on all of the other SCADA screens and the values logged to primary data file are the "calibrated" values shown above callout D after the application of the linear correction factors. A capable metrology lab or certified reference device can assist in determining these values.

The button on the right of the screen at callout E labeled "Enable (or Disable) Calibration Log" will enable the recording of the "raw" values from the sensors. With the calibration log enabled, the raw data is collected every 5 seconds to a data file located in "C:\Data". This data can be compared to the reference measurements using a linear regression procedure to calculate correction factors that will map the raw values into calibrated engineering units.

The calibration factors can then be entered on the calibration screen, but these values will be replaced with the default values the next time the control strategy is downloaded to the PAC. Any values that have been entered on this screen will revert back to those stored in the "C:\ Gasifier Opto\PAC Control\Main Control\Init.txt" file. For this reason, it is good practice to update the "Init.txt" file as soon as new calibration data is available. ARCADIS staff in the EPA metrology laboratory are familiar with this file and can assist in modifying it with the appropriate values. Instead of entering the scale and offset manually on the screen, it is typically easier and more accurate to download the PAC Control program and let the values be updated directly from the "Init.txt" file. See the PAC Control User Guide (Reference 2) for additional information on downloading strategies. The contents of the "Init.txt" file are similar to the following text containing scale and offset values for all of the sensors:

```
\ ""DOWNLOAD_COMPRESSION_OFF

1.0 1 }TE_Scale TABLE!
1.0 2 }TE_Scale TABLE!
1.0 3 }TE_Scale TABLE!
1.0 4 }TE_Scale TABLE!
```

```
1.0 5 }TE_Scale TABLE!
1.0 6 }TE_Scale TABLE!
1.0 7 }TE_Scale TABLE!
1.0 8 }TE_Scale TABLE!
1.0 9 }TE_Scale TABLE!
1.0 10 }TE_Scale TABLE!
1.0 11 }TE_Scale TABLE!
1.0 12 }TE_Scale TABLE!
1.0 13 }TE_Scale TABLE!
1.0 14 }TE_Scale TABLE!
1.0 15 }TE_Scale TABLE!
1.0 16 }TE_Scale TABLE!
1.0 17 }TE_Scale TABLE!
1.0 18 }TE_Scale TABLE!
1.0 19 }TE_Scale TABLE!
1.0 20 }TE_Scale TABLE!
1.0 21 }TE_Scale TABLE!
1.0 22 }TE_Scale TABLE!

0.0 1 }TE_Offset TABLE!
0.0 2 }TE_Offset TABLE!
0.0 3 }TE_Offset TABLE!
0.0 4 }TE_Offset TABLE!
0.0 5 }TE_Offset TABLE!
0.0 6 }TE_Offset TABLE!
0.0 7 }TE_Offset TABLE!
0.0 8 }TE_Offset TABLE!
0.0 9 }TE_Offset TABLE!
0.0 10 }TE_Offset TABLE!
0.0 11 }TE_Offset TABLE!
0.0 12 }TE_Offset TABLE!
0.0 13 }TE_Offset TABLE!
0.0 14 }TE_Offset TABLE!
0.0 15 }TE_Offset TABLE!
0.0 16 }TE_Offset TABLE!
0.0 17 }TE_Offset TABLE!
0.0 18 }TE_Offset TABLE!
0.0 19 }TE_Offset TABLE!
0.0 20 }TE_Offset TABLE!
0.0 21 }TE_Offset TABLE!
```

```
0.0 22 }TE_Offset TABLE!
0.0 23 }TE_Offset TABLE!
0.0 24 }TE_Offset TABLE!

1000.0 1 }Alm_Limits_Hi TABLE!
1000.0 2 }Alm_Limits_Hi TABLE!
816.0 3 }Alm_Limits_Hi TABLE!
816.0 4 }Alm_Limits_Hi TABLE!
193.0 5 }Alm_Limits_Hi TABLE!
850.0 6 }Alm_Limits_Hi TABLE!

0.0 1 }Alm_Limits_Lo TABLE!
0.0 2 }Alm_Limits_Lo TABLE!
0.0 3 }Alm_Limits_Lo TABLE!
0.0 4 }Alm_Limits_Lo TABLE!
0.0 5 }Alm_Limits_Lo TABLE!
140.0 6 }Alm_Limits_Lo TABLE!
```

Figure 27. Calibration Screen

8.7 Log Files

The operator interface (PAC Display) creates four historical data files. The variables and the recording frequency for each are described in this section.

Primary Historical Data Log – 10 second samples (C:\Data*date*.h06)

The primary historical data log contains the current operating conditions of the gasifier system vs. time. The values recorded are after the application of the scale and offset calibration factors. The following parameters are recorded in the primary data log every 10 seconds:

- Date
- Time
- TE_111_Surge_Bin_Screw (C) temperature
- TE_112_Surge_Bin_Screw (C) temperature
- TE_211_Primary_Chamber (C) temperature
- TE_212_Primary_Chamber (C) temperature
- TE_213_Secondary_Chamber (C) temperature
- TE_214_Secondary_Chamber (C) temperature
- TE_215_Downstream_of_Burner (C) temperature
- TE_216_Drag_Chain_Drive_Box (C) temperature
- TE_221_Primary_Chamber (C) temperature
- TE_222_Primary_ChambeR (C) temperature
- TE_223_Secondary_Chamber (C) temperature
- TE_224_Secondary_Chamber (C) temperature
- TE_225_Downstream_of_Burner (C) temperature
- TE_226_Drag_Chain_Drive_Box (C) temperature
- TE_231_Ash_Auger (C) temperature
- TE_232_Ash_Auger_Exit (C) temperature
- TE_233_Stack (C) temperature
- TE_241_Ambient (C) temperature

Sample:

```
Date,Time,TE_111_Surge_Bin_Screw (C),TE_112_Surge_Bin_Screw
(C),TE_211_Primary_Chamber (C),TE_212_Primary_Chamber
(C),TE_213_Secondary_Chamber (C),TE_214_Secondary_Chamber
```

```
(C),TE_215_Downstream_of_Burner (C),TE_216_Drag_Chain_Drive_Box
(C),TE_221_Primary_Chamber (C),TE_222_Primary_ChambeR
(C),TE_223_Secondary_Chamber (C),TE_224_Secondary_Chamber
(C),TE_225_Downstream_of_Burner (C),TE_226_Drag_Chain_Drive_Box
(C),TE_231_Ash_Auger (C),TE_232_Ash_Auger_Exit (C),TE_233_Stack
(C),TE_241_Ambient (C)

2015/03/02,11:59:32,13.152,13.327,7.638,7.115,6.316,6.466,6.366,7
.713,7.414,7.015,6.166,5.992,5.842,7.339,6.466,8.786,6.491,11.830

2015/03/02,11:59:42,13.202,13.377,7.638,7.040,6.341,6.341,6.316,7
.663,7.414,7.164,5.967,5.942,6.017,7.439,6.491,8.811,6.616,11.980

2015/03/02,11:59:52,13.277,13.402,7.638,7.115,6.191,6.241,6.341,7
.688,7.489,7.214,6.042,6.017,5.992,7.489,6.491,8.811,6.541,11.830

2015/03/02,12:00:02,13.177,13.377,7.564,7.189,6.366,6.441,6.266,7
.688,7.514,7.164,6.216,6.042,5.942,7.439,6.391,8.786,6.516,11.855
```

The refresh time is currently set at 10 seconds for the primary log. This can be changed within the PAC Display Configurator program: Configure/Historic Data Log/Primary/Modify/Refresh Time/ and then select a new time.

Calibration Historical Data Log – 5-second samples (C:\Data\date.h05)

The calibration data log is only enabled during calibration periods to record the raw values of temperature and mA. This data log writes values every 5 seconds to provide additional data for averaging prior to the calibration regression calculations. The parameters recorded and the format are the same as for the primary log.

Alarm Log (C:\Data\Alarms*date*.alm)

The alarm log provides a time stamped text record of all alarm events.

Sample:

```
10:28:56,2014/12/08,Power_Monitor,FALSE,In Alarm,0,Power Failure
12:15:16,2014/12/08,Power_Monitor,FALSE,In Alarm,0,Power Failure
```

9.0 SAMPLE COLLECTION, PRESERVATION, AND STORAGE

There are no sampling events associated with this SOP.

10.0 SAMPLE ANALYSIS PROCEDURE

There are no sample analyses associated with this SOP.

11.0 DATA ANALYSIS AND CALCULATIONS

The data is logged to comma separated values (CSV) files as described in Section 8.14 and are stored in "C:\Data". A new file is started daily with the naming convention: RDYYMMDD.H06. The files can be easily imported into a spreadsheet or other program for data reduction or statistical analysis.

12.0 COMPUTER HARDWARE AND SOFTWARE

The SCADA computer is connected to the main control panel through an Ethernet switch located in the control panel. A custom "Project" has been configured within Opto 22's PAC Display Configurator and runs with Opto 22's PAC Display Runtime. This "Project" is the basis of the SCADA system. A custom "Strategy" has been configured with Opto 22's PAC Control program that runs on the PAC located inside the main control panel and the one located inside the power distribution panel. These processors communicate with all of the field devices, maintain interlocks, and control all of the PID loops. See References 1 and 2 for additional information the Opto 22 software.

13.0 DATA AND RECORDS MANAGEMENT

The logged environmental data files are stored on the hard drive of the SCADA computer in "C:\Data". Backups of the data and the Opto 22 configuration files in the "C:\Gasifier Opto" folder should be performed at least every 6 months. Descriptions of test plan experiments should be recorded in laboratory notebooks.

14.0 QUALITY ASSURANCE

Environmental sensors (temperature, humidity, pressure, differential pressure, and flow) should be calibrated at least once a year.

15.0 PERIODIC MAINTENANCE

The SCADA system requires very little maintenance other than data backup and associated instrument calibration. UPS batteries should be replaced every 3 to 5 years.

Beginning of every test: Verify that all temperature, humidity, differential pressure, and absolute pressure transmitters are displaying reasonable values. With the system off for an extended period of time, all temperature sensors should indicate readings close to ambient temperatures. Perform daily instrument calibrations required by the quality assurance (QA) plan.

Monthly: Perform monthly instrument calibrations and QA checks required by the QA plan. Confirm proper operation of the flame safety system and associated sensors, valves, and interlocks. Refer to the maintenance section of the gasifier O&M Manual for control system hardware maintenance schedules. This manual contains reference manuals for all of the component systems.

Yearly: Refer to the maintenance section of the gasifier O&M Manual for control system hardware maintenance schedules. This manual contains reference manuals for all of the component systems. The Grinding, Transfer, Accumulation, and Feed (GTAF) System Manual can be seen in Appendix C.

16.0 TROUBLESHOOTING

If normal troubleshooting procedures, including those listed in the equipment manuals of the ARCADIS gasifier O&M Manual do not solve the problem, call the gasifier control system integrator:

ARCADIS U.S., Inc.
4915 Prospectus Drive
Durham, NC 27713
919-544-4535

Rendeq Inc
1813 Frank Holt Drive
Burlington, NC 27215
336-226-1100

Eclipse, Inc.
5959 Shallowford Road
Chattanooga, TN 37421
423-643-2180

Joe Moore & Company
1431 Gavin Street
Raleigh, NC 27608
919-832-1665

Jim Howard

6117 Riverside Drive
Wake Forest, NC 27587
919-306-0409

17.0 REFERENCES

1. PAC Display User's Guide, Form 1702-110720—July 2011, Opto 22, Temecula, CA 92590-3614.
2. PAC Control User's Guide, Form 1700-110720—July 2011, Opto 22, Temecula, CA 92590-3614.
3. Operation and Maintenance Manual, C9 Generator Set, March 2006, Caterpillar, Mossville, IL 61552-0610.

APPENDIX B: Gasifier Schematics

U.S. Environmental Protection Agency
Transportable Gasifier Control System
Research Triangle Park, NC

For U.S. Environmental Protection Agency
109 T.W. Alexander Drive, RTP, North Carolina 27711
Phone: (919)541-3817 Fax: (919)541-XXXX

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E-3.3 Control Panel Power Distribution
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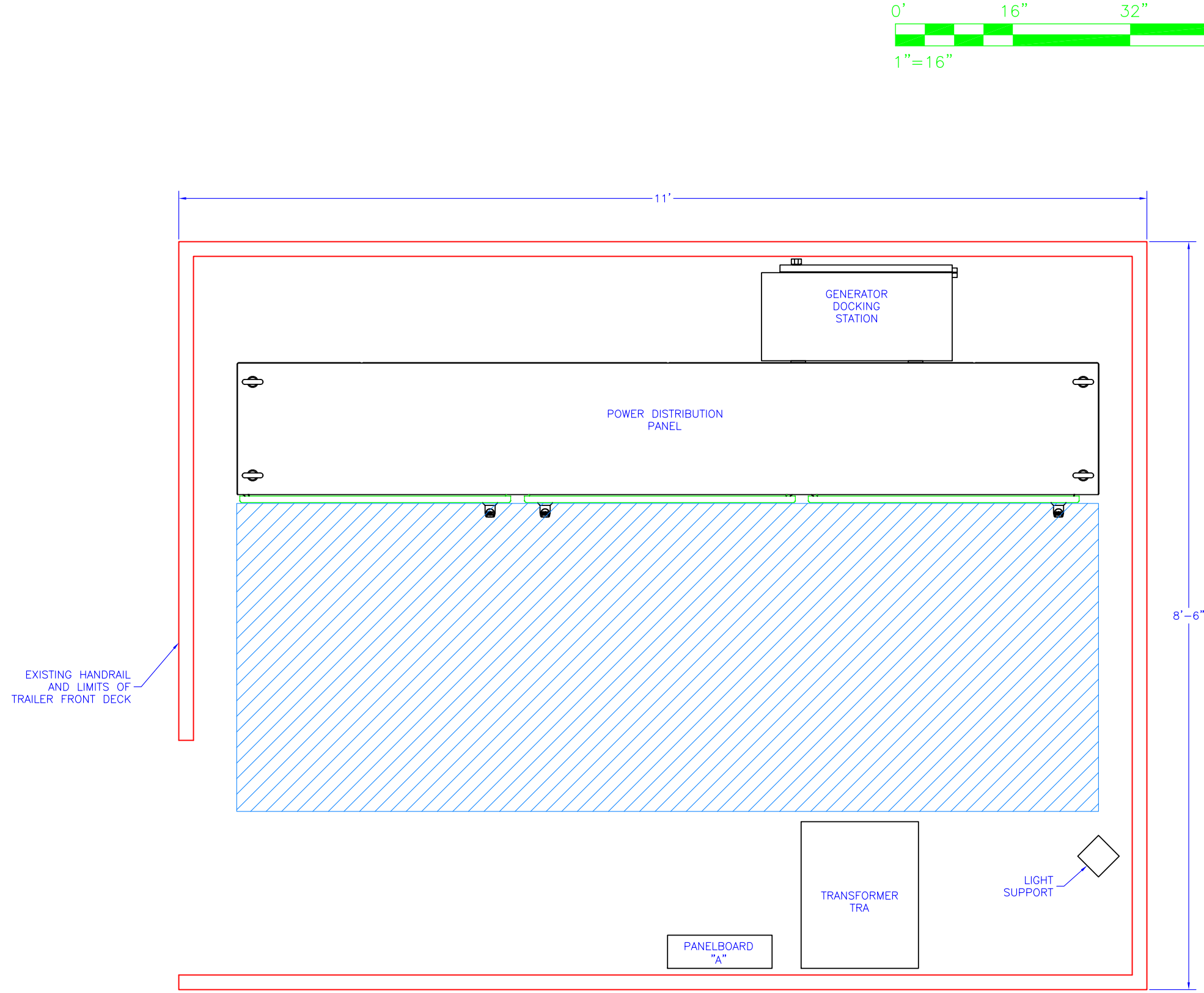
UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

ARCADIS

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F
Durham, North Carolina 27713
Tel: 919-544-4535 Fax: 919-544-5690



TRAILER FRONT
DECK PLAN VIEW

REV.	ISSUED DATE	DESCRIPTION
1	2/27/14	ISSUED FOR REVIEW

ARCADIS

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
www.arcadis-us.com

PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

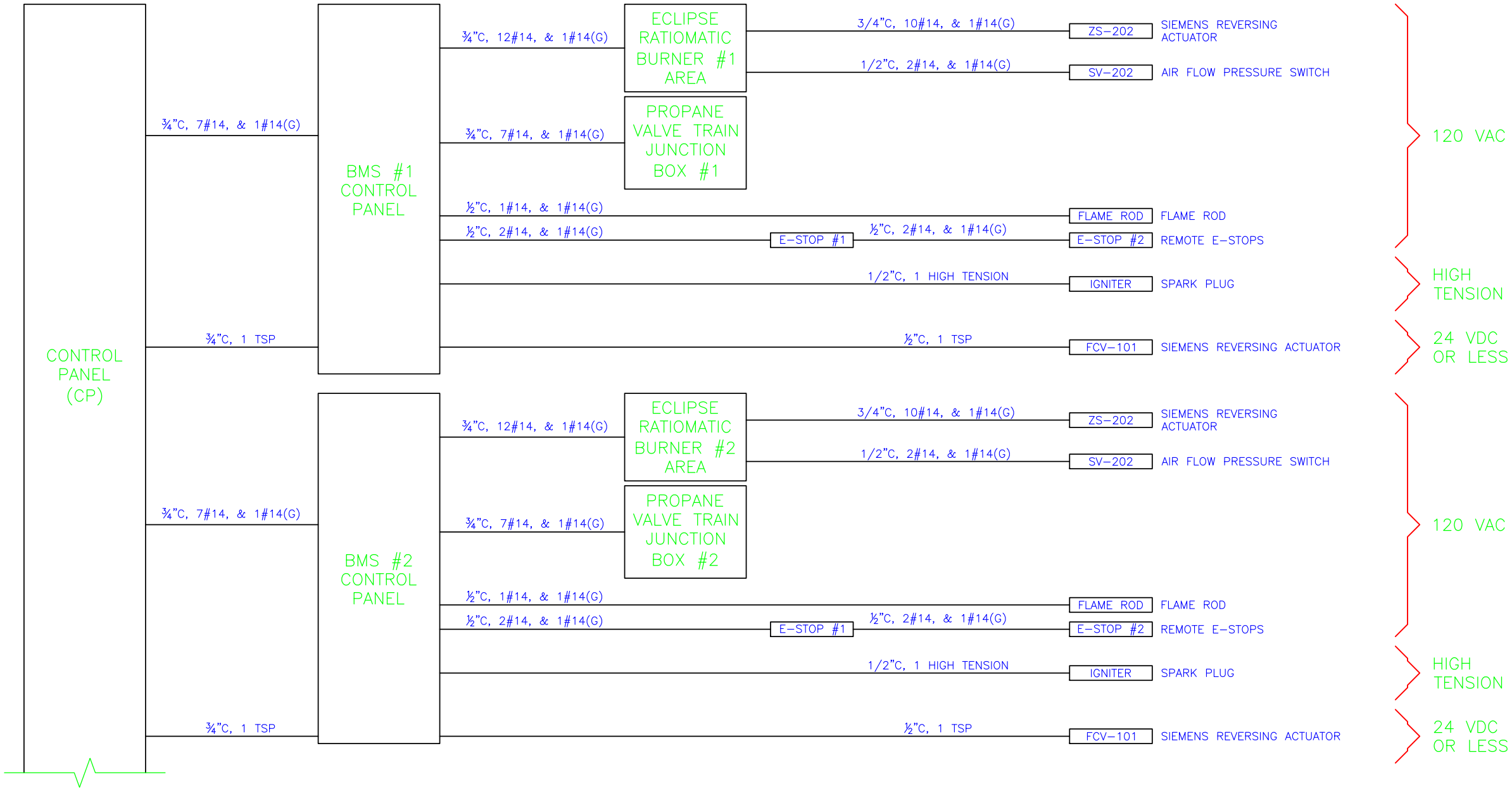
UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY
TRANSPORTABLE GASIFIER
TRAILER FRONT DECK LAYOUT

PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER **E-1.1**

Acad Version : R19.1s (LMS Tech) Date\Time : Mon, 22 Jun 2015 — 11:47am
User Name : bsharpe Path\Name : G:\Active Projects\Environmental Monitoring & Engineering\2013 Projects\WA1-24 Gasifier\Controls\Panel.dwg
Current Plotstyle : ByColor
Layout : E-1.1

NOTES

1. MULTI-CONDUCTOR CABLE INFORMATION
   BELDEN 8760 18 AWG, TSP, NOM. OD = 0.222"
   BELDEN 9534 24 AWG, 4 CONDUCTOR NOM. OD = 0.184"
   BELDEN 9536 24 AWG, 6 CONDUCTOR NOM. OD = 0.209"
   BELDEN 9540 24 AWG, 10 CONDUCTOR NOM. OD = 0.244"
   STEREN 300-783, 24 AWG SOLID, CAT5E UTP, OD = 0.212"
2. USE TYPE KX THERMOCOUPLE EXTENSION WIRE, 20 GA SOLID, UL LISTED TYPE PLTC, OD ≈0.137x0.204".
3. ALL LOW VOLTAGE (≤24 VDC) WIRING IS SUPPLIED FROM UL LISTED CLASS 2 POWER SUPPLIES.
4. ADJUST WIRE AND CONDUIT SIZES TO MEET AMPACITY AND CONDUIT FILL REQUIREMENTS FOR LOADS AND OPERATING CONDITIONS.
5. –
6. –



REV.	ISSUED DATE	DESCRIPTION
1	3/5/14	ISSUED FOR REVIEW

ARCADIS
ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
www.arcadis-us.com

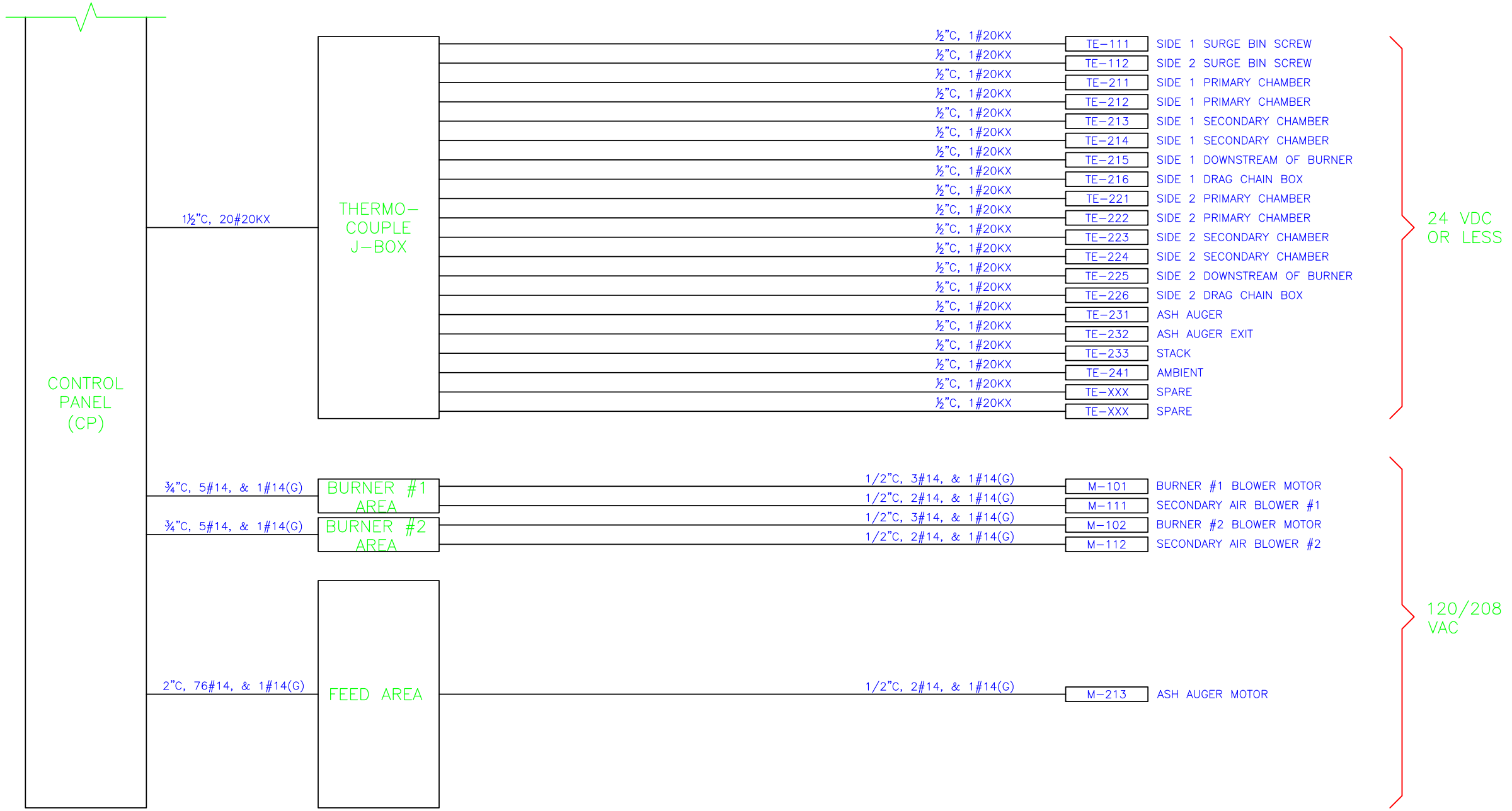
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
RISER DIAGRAM

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER **E-1.2**



REV.	ISSUED DATE	DESCRIPTION
1	3/5/14	ISSUED FOR REVIEW

ARCADIS
ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
www.arcadis-us.com

PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
RISER DIAGRAM

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-1.3

Acad Version : R19.1s (LMS Tech)
User Name : bsharpe
Date\Time : Mon, 22 Jun 2015 - 11:46am
Path\Name : G:\Active Projects\Environmental Monitoring & Engineering\2013 Projects\WA 4-21 Gasifier\Controls\Ele Riser.dwg

NOTES

1. DIMENSIONS SHOWN ARE FOR REFERENCE PURPOSES ONLY.
2. TERMINAL BLOCKS AND WIREWAY SHOULD BE ARRANGED TO FACILITATE FIELD CONNECTIONS.
3. COMPONENTS SHOWN ARE TO SCALE. DEVIATIONS FROM THE GENERAL ARRANGEMENT SHOWN HERE ARE SUBJECT TO APPROVAL BY ARCADIS.
4. TERMINAL BLOCKS FOR HIGH VOLTAGE (>100 VAC) FIELD WIRING MUST BE LARGE ENOUGH TO ACCEPT #14 AWG.
5. PANDUIT (WIREWAY) AS SHOWN IN DRAWING MAY PASS OVER INTERNAL PANEL MOUNTING STUDS/NUTS. CUT HOLE IN BACK OF PANDUIT TO ALLOW CLEARANCE.
6. UL 508 LISTING AND LABELING IS REQUIRED FOR THIS PANEL ASSEMBLY.
7. –

REV.	ISSUED DATE	DESCRIPTION
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ARCADIS
ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
www.arcadis-us.com

PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

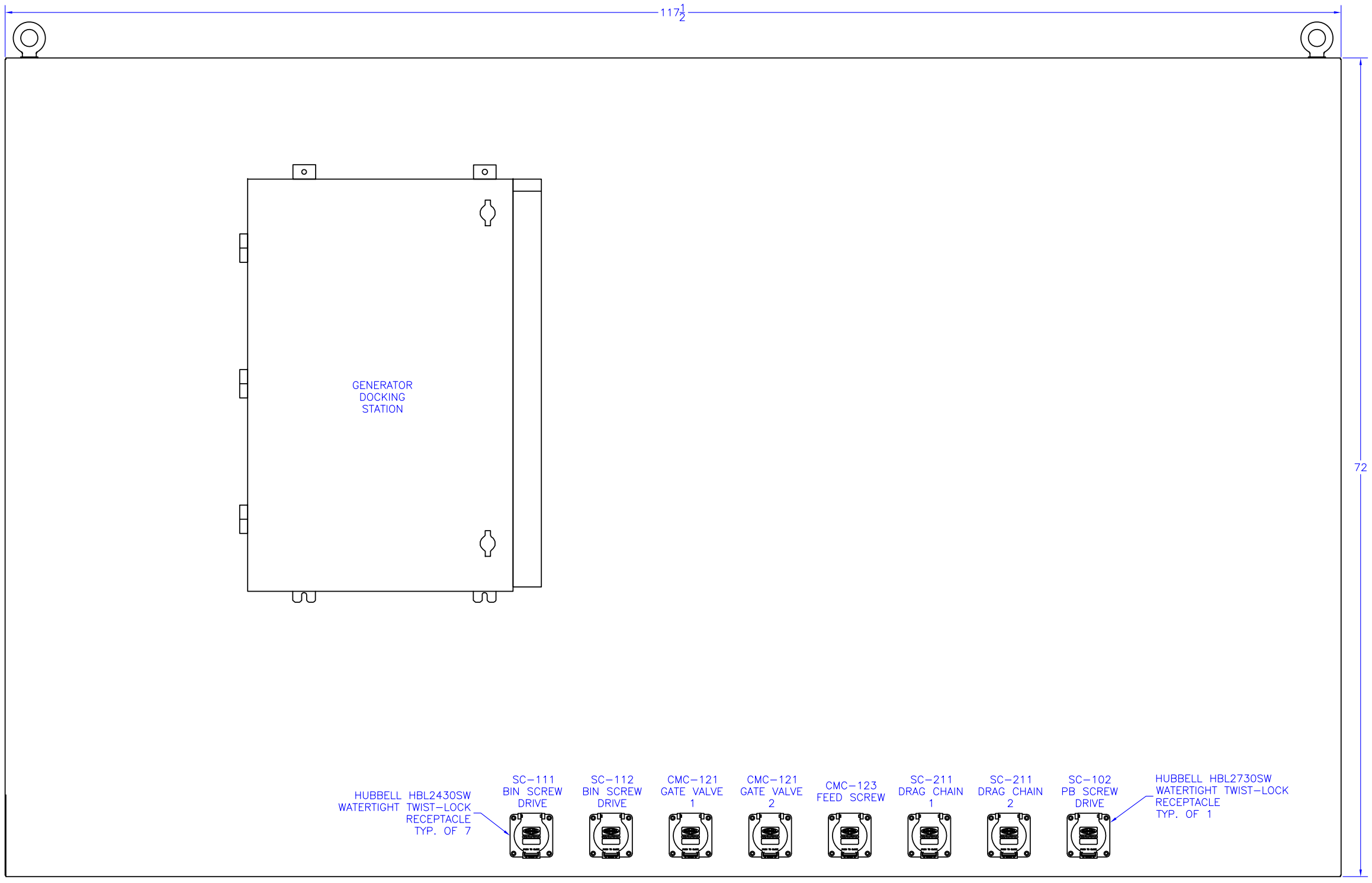
SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL FRONT LAYOUT

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY
00001	R. SHARPE
PROJECT NUMBER	DRAWING NUMBER
RN990274.0021	**E-2.1**

0' 0.1" 0.2" 0.3"

1"=0.1"



PANEL REAR VIEW

REV.	ISSUED DATE	DESCRIPTION
1	2/27/14	ISSUED FOR REVIEW

ARCADIS

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
www.arcadis-us.com

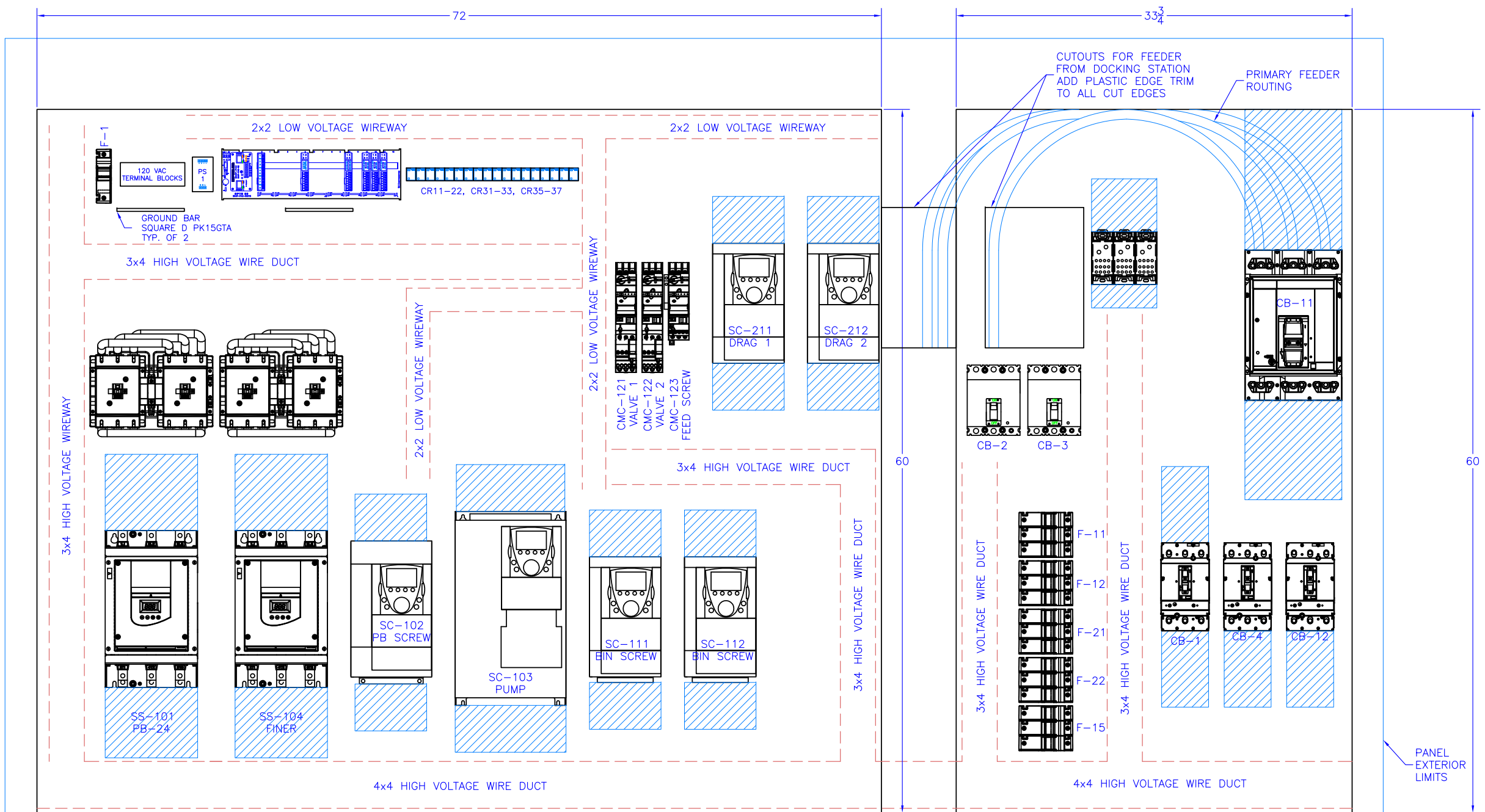
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL REAR LAYOUT

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY
00001	R. SHARPE
PROJECT NUMBER	DRAWING NUMBER
RN990274.0021	E-2.2



INTERIOR PANEL LAYOUT

0' 0.1" 0.2" 0.3"

1"=0.1"

REV.	ISSUED DATE	DESCRIPTION
1	2/27/14	ISSUED FOR REVIEW

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ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax: 919-544-5690
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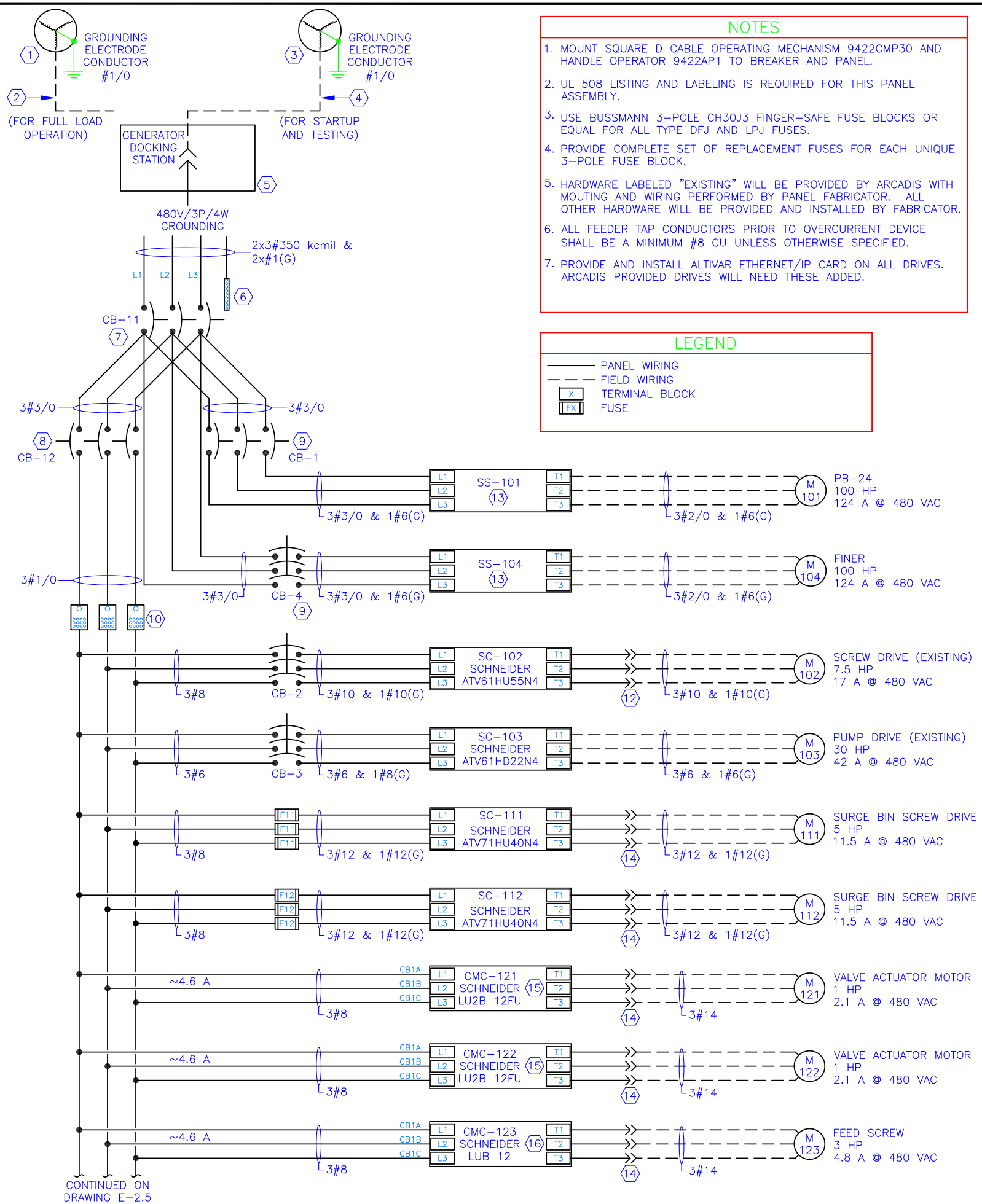
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL INTERNAL LAYOUT

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-2.3



NOTES

1. MOUNT SQUARE D CABLE OPERATING MECHANISM 9422CMP30 AND HANDLE OPERATOR 9422AP1 TO BREAKER AND PANEL.
2. UL 508 LISTING AND LABELING IS REQUIRED FOR THIS PANEL ASSEMBLY.
3. USE BUSSMANN 3-POLE CH30J3 FINGER-SAFE FUSE BLOCKS OR EQUAL FOR ALL TYPE DFJ AND LPJ FUSES.
4. PROVIDE COMPLETE SET OF REPLACEMENT FUSES FOR EACH UNIQUE 3-POLE FUSE BLOCK.
5. HARDWARE LABELED "EXISTING" WILL BE PROVIDED BY ARCADIS WITH MOUTING AND WIRING PERFORMED BY PANEL FABRICATOR. ALL OTHER HARDWARE WILL BE PROVIDED AND INSTALLED BY FABRICATOR.
6. ALL FEEDER TAP CONDUCTORS PRIOR TO OVERCURRENT DEVICE SHALL BE A MINIMUM #8 CU UNLESS OTHERWISE SPECIFIED.
7. PROVIDE AND INSTALL ALTIVAR ETHERNET/IP CARD ON ALL DRIVES. ARCADIS PROVIDED DRIVES WILL NEED THESE ADDED.

LEGEND

- PANEL WIRING
- FIELD WIRING
- X — TERMINAL BLOCK
- FX — FUSE

FUSE SPECIFICATIONS

TAG	AMPS	CLASS	TYPE	MODEL
F-1	10	J	TIME-DELAY	BUSSMANN LPJ-10SP
F-11	20	J	DRIVE FUSE	BUSSMANN DFJ-20
F-12	20	J	DRIVE FUSE	BUSSMANN DFJ-20
F-21	20	J	DRIVE FUSE	BUSSMANN DFJ-20
F-22	20	J	DRIVE FUSE	BUSSMANN DFJ-20
F-15	25	J	TIME-DELAY	BUSSMANN LPJ-25SP

CIRCUIT BREAKER SPECIFICATIONS

TAG	AMPS	POLES	SC RATING	MODEL
CB-1	200	3	35kA	SQUARE D JGL36200
CB-2	30	3	18kA	SQUARE D FAL34030*
CB-3	100	3	18kA	SQUARE D FAL34100*
CB-4	200	3	35kA	SQUARE D JGL36200
CB-11	600	3	35kA	SQUARE D MGL36600
CB-12	175	3	35kA	SQUARE D JGL36175
				*EXISTING - PROVIDED BY ARCADIS, INSTALLED BY FABRICATOR

1. 320 kW RENTAL GENERATOR SET WITH 4/0 PARALLELED CONDUCTORS AND CAM LOCK LEADS
2. 2x3#4/0 & 2x#4/0 GROUND (90°C TYPE W CABLE WITH CAM-STYLE ENDS)
3. EXISTING 225 kW CATERPILLAR C9 GENERATOR SET WITH BUILT IN 400 AMP 35 kAIC CIRCUIT BREAKER. INSTALL TRYSTAR 400 AMP GLAND PLATE GLD-ALS-4004-FSS-F WITH PLASTIC FLIP COVERS FOR CAM-LOCK CABLE CONNECTIONS.
4. 3#4/0 & 1#4/0 GROUND (90°C TYPE W CABLE WITH CAM-STYLE ENDS)
5. 600 AMP 480V/3ø/4-WIRE WALL MOUNT TRYSTAR GENERATOR DOCKING STATION. TWO SETS OF MALE CAM-LOCKS PER PHASE. LOAD LUGS ARE RATED FOR (2) #4-600 MCM CABLES.
6. PANDUIT 18-PORT UNIVERSAL GROUND BAR MODULE UGB2/0-414-18 MOUNTED WITH TWO BONDING STAND-OFFS UGB-B-SO AND ADDITIONAL CLMAR2/0-14-Q CONNECTOR FOR PARALLELED 2/0 GROUND CONDUCTORS.
7. SQUARE D POWERPACT M-FRAME 600 AMP MOLDED CASE CIRCUIT BREAKER MGL36600. STANDARD LUG CONFIGURATION: (3) 3/0 AWG-500 kcmil PER LUG.
8. POWERPACT J-FRAME THERMAL-MAGNETIC CIRCUIT BREAKER JGL36175. STANDARD LUG CONFIGURATION: (1) 4-4/0 AWG AL OR CU.
9. CB-1 AND CB-4 ARE SQUARE D POWERPACT J-FRAME THERMAL-MAGNETIC CIRCUIT BREAKERS JGL36200. STANDARD LUG CONFIGURATION: (1) 3/0 AWG-350 kcmil AL OR CU.
10. BUSSMANN ENCLOSED POWER DISTRIBUTION BLOCKS MODEL PDBFS377 (3 RQD). GANG TOGETHER WITH ACCESSORY PART 2A1279 INTERLOCKING DOVETAIL (2 RQD).
    LINE SIDE: 300KCMIL TO 4 AWG
    LOAD SIDE: 4 TO 14 AWG
11. NEMA 3R XFMR TRA 15kVA 480-208Y/120V 3ø, 4W 150° C RISE. SQUARE D EE15T3H WITH WS363 WEATHERSHIELD OR EQUAL.
12. HUBBELL HBL2730SW WATERTIGHT TWIST-LOCK RECEPTACLE TYP. OF 3
13. SCHNEIDER ELECTRIC ATS48C14Y SOFT START WITH LC2D115G6 REVERSING CONTACTOR. FORWARD AND REVERSE CONTACTORS SHALL BE BE FITTED WITH SCHNEIDER ELECTRIC LADN02 FRONT MOUNTED AUXILLARY CONTACT BLOCKS (2 NC CONTACTS).
14. HUBBELL HBL2430SW WATERTIGHT TWIST-LOCK RECEPTACLE TYP. OF 3
15. SCHNEIDER ELECTRIC COMBINATION REVERSING MOTOR CONTROLLER. LU2B 12FU STARTER BASE WITH LUCA 05FU CONTROL UNIT AND LINE PHASE BARRIER LU9SP0.
16. SCHNEIDER ELECTRIC COMBINATION MOTOR CONTROLLER. LUB 12 STARTER BASE WITH LUCA 12FU CONTROL UNIT AND LINE PHASE BARRIER LU9SP0.

REV.	ISSUED DATE	DESCRIPTION
1	3/17/14	ISSUED FOR REVIEW

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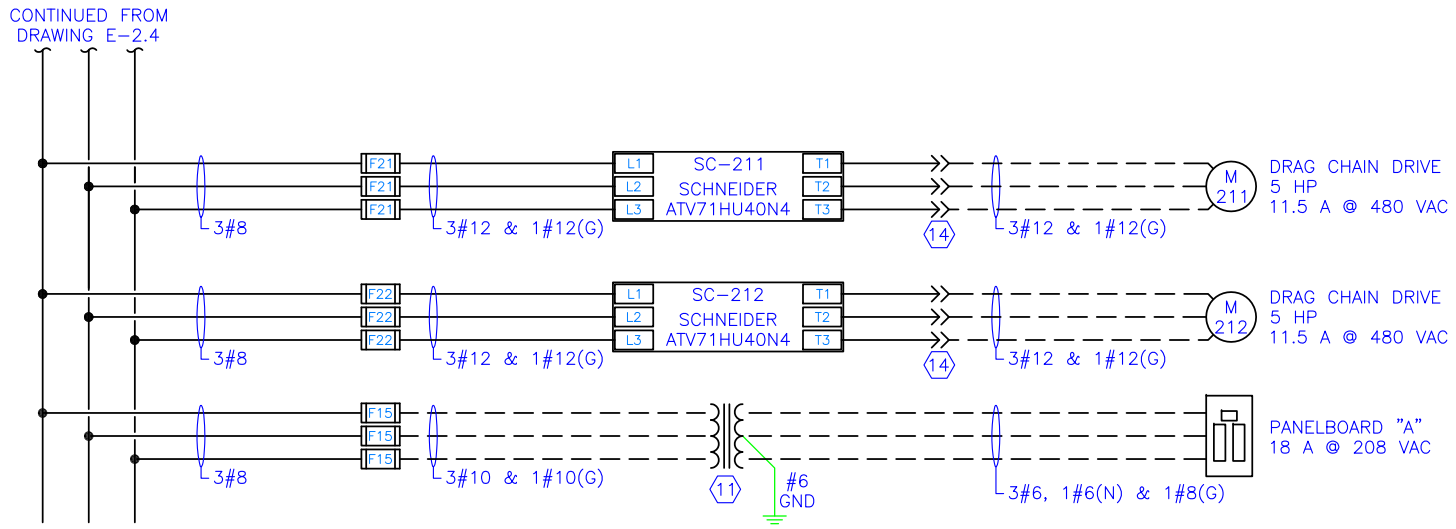
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
480 VAC DISTRIBUTION SCHEMATIC

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-2.4



PANELBOARD "A"

VOLTAGE: 208/120V, 3ø, 4W
BUS RATING: 60 AMP MCB
MOUNTING: SURFACE MOUNTED
MIN AIC: 10,000 AMPS SYM. RMS

CIRCUIT DESCRIPTION	CIRC. BKR.	CIRC. NO.	PH. A LOAD	PH. B LOAD	PH. C LOAD	CIRC. NO.	CIRC. BKR.	CIRCUIT DESCRIPTION
MAIN BREAKER 3#6, #6 N, #8 GROUND – 1" C	60A 3P	1	–				40A 3P	GASIFIER CONTROL PANEL 3#8, #8 N, #10 GROUND – 3/4" C
			3300			2		
		3		–				
				3600		4		
		5			–			
					2100	6		
LIGHTS 2#12, #12 GROUND – 3/4" C	20A 1P	7	360				15A 1P	MAIN POWER DISTRIBUTION PANEL 2#12, #12 GROUND – 3/4" C
			360			8		
RECEPTACLE – GENERATOR TRAILER 2#12, #12 GROUND – 3/4" C	20A 1P	9		360			20A 1P	RECEPTACLE – GASIFIER TRAILER 2#12, #12 GROUND – 3/4" C
				360		10		
SPARE –	20A 1P	11			–		20A 1P	SPARE –
					–	12		
SPARE –	20A 1P	13	–				20A 1P	SPARE –
			–			14		
–	–	15		–			–	–
–	–			–		16	–	–
–	–	17			–		–	–
–	–				–	18	–	–
–	–	19	–				–	–
–	–		–			20	–	–
–	–	21		–			–	–
–	–			–		22	–	–
–	–	23			–		–	–
–	–				–	24	–	–
–	–	25	–				–	–
–	–		–			26	–	–
–	–	27		–			–	–
–	–			–		28	–	–
–	–	29			–		–	–
–	–				–	30	–	–
CONNECTED LOAD PER PHASE			4020	4320	2100	AMP. LOAD = 29.0 AMPS		

NOTES

1. PANELBOARD "A" CORRESPONDS TO SQUARE D LOAD CENTER QO327M100RB OR EQUAL, CURRENT RATING 100 AMPS, MAXIMUM NUMBER OF SINGLE POLE BREAKERS 27, NUMBER OF SPACES 27, SURFACE COVER SQUARE D QOC30US, SQUARE D GROUND BAR KIT PK15GTA, HEIGHT 30.00 INCHES, WIDTH 14.25 INCHES, DEPTH 4.52 INCHES, NEMA 3R RAINPROOF MODEL, THREE PHASE, 60 AMP MAIN BREAKER.
2. –
3. –
4. –
5. –

REV.	ISSUED DATE	DESCRIPTION
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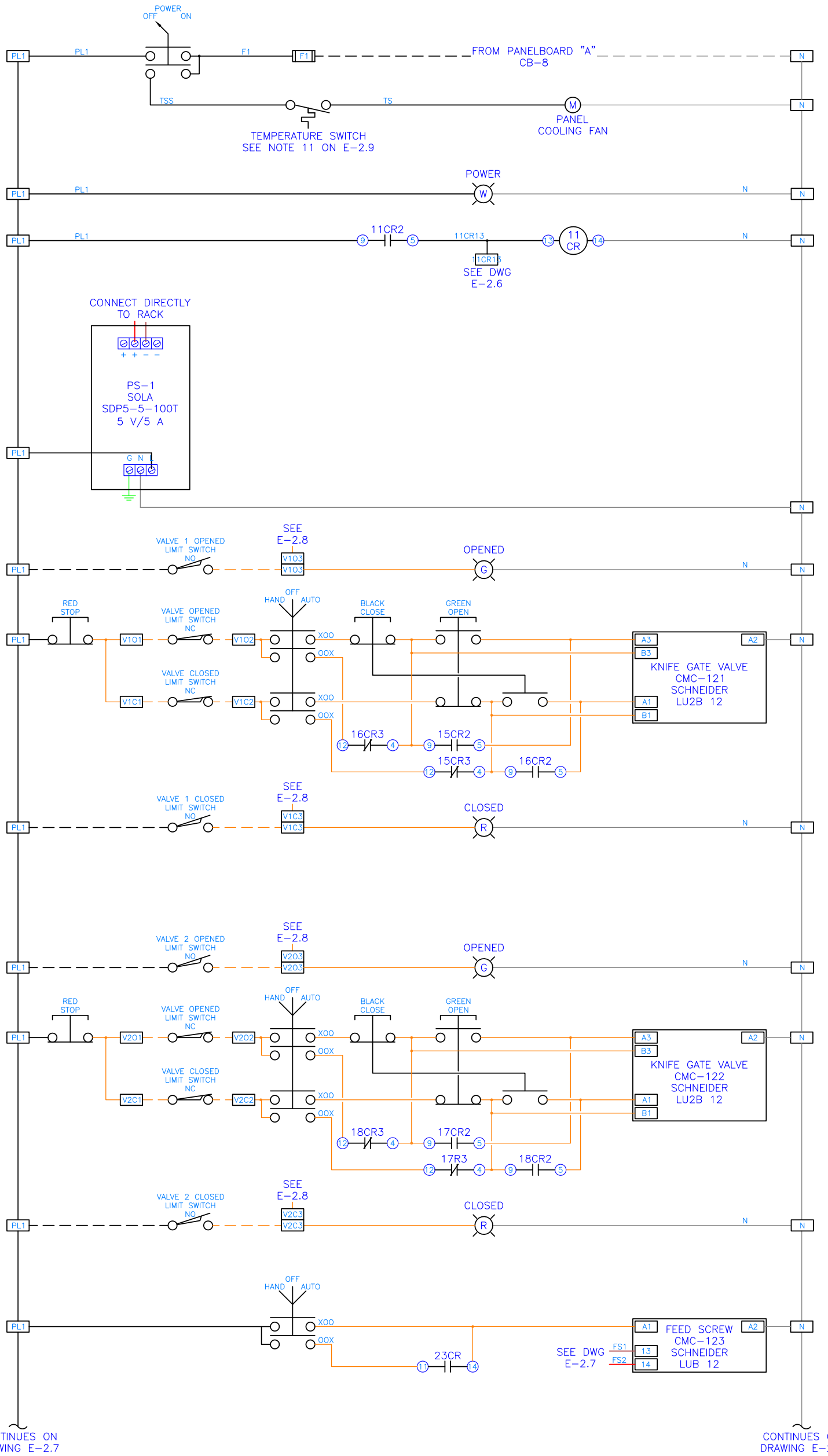
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
PANEL SCHEDULE

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY
00001	R. SHARPE
PROJECT NUMBER	DRAWING NUMBER
RN990274.0021	E-2.5



REV.	ISSUED DATE	DESCRIPTION
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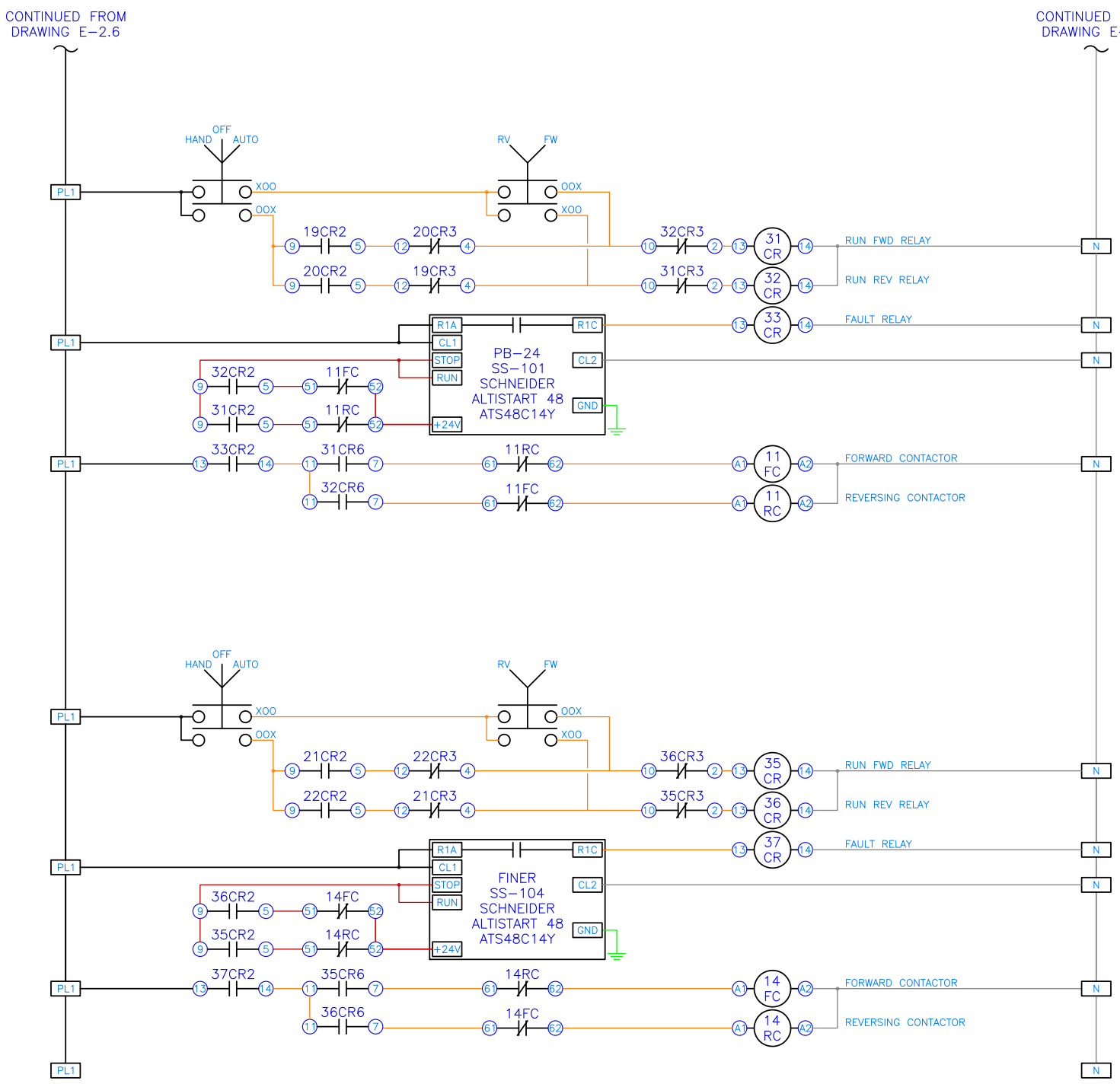
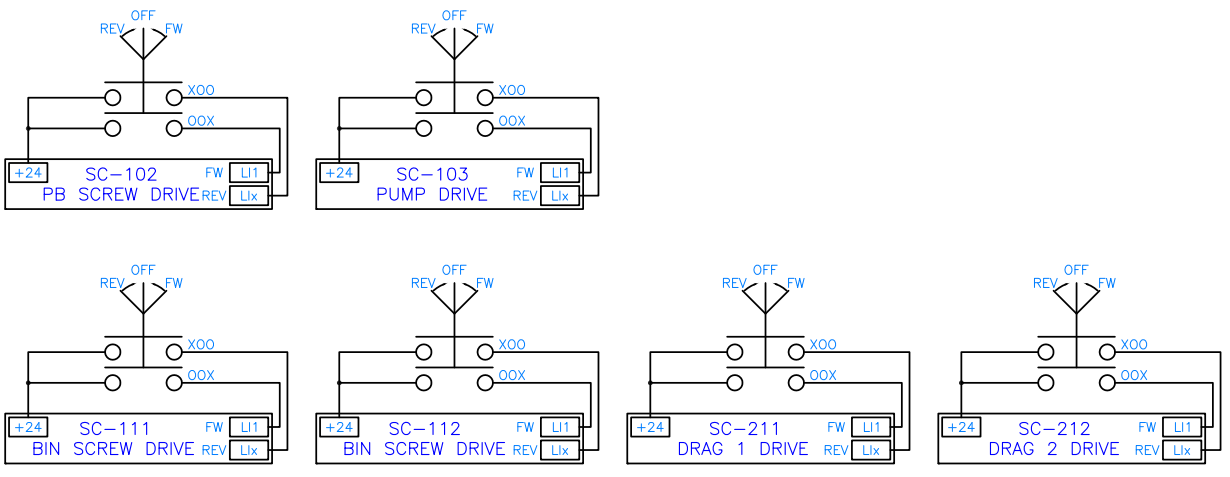
PROJECT TITLE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL CTRLS SCHEMATIC

SHEET TITLE

PROJECT MANAGER B. HALL
DEPARTMENT MANAGER
LEAD DESIGN PROF.
CHECKED BY
TASK/PHASE NUMBER 00001
DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021
DRAWING NUMBER **E-2.6**





REV.	ISSUED DATE	DESCRIPTION
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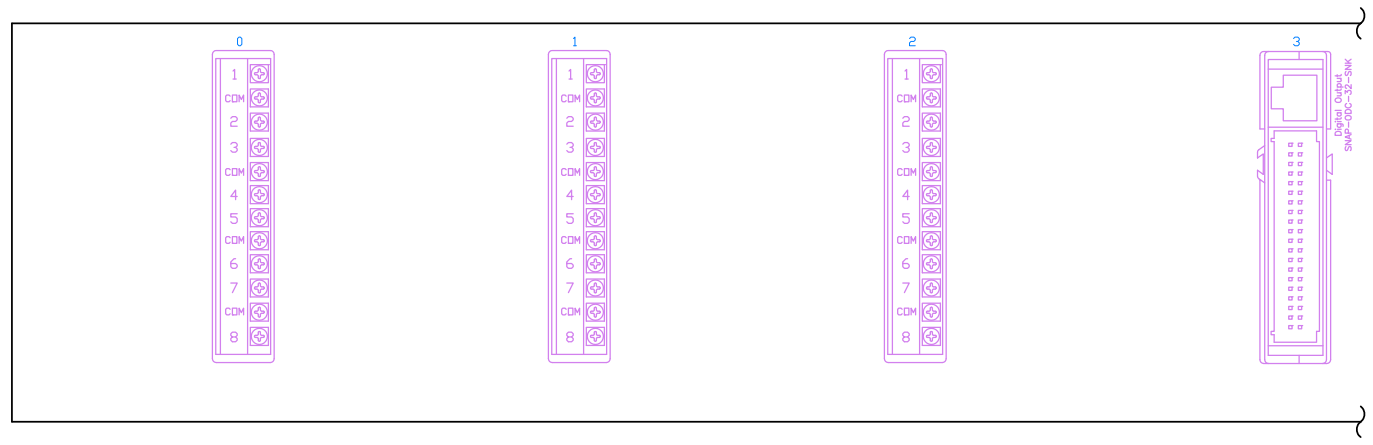
PROJECT TITLE

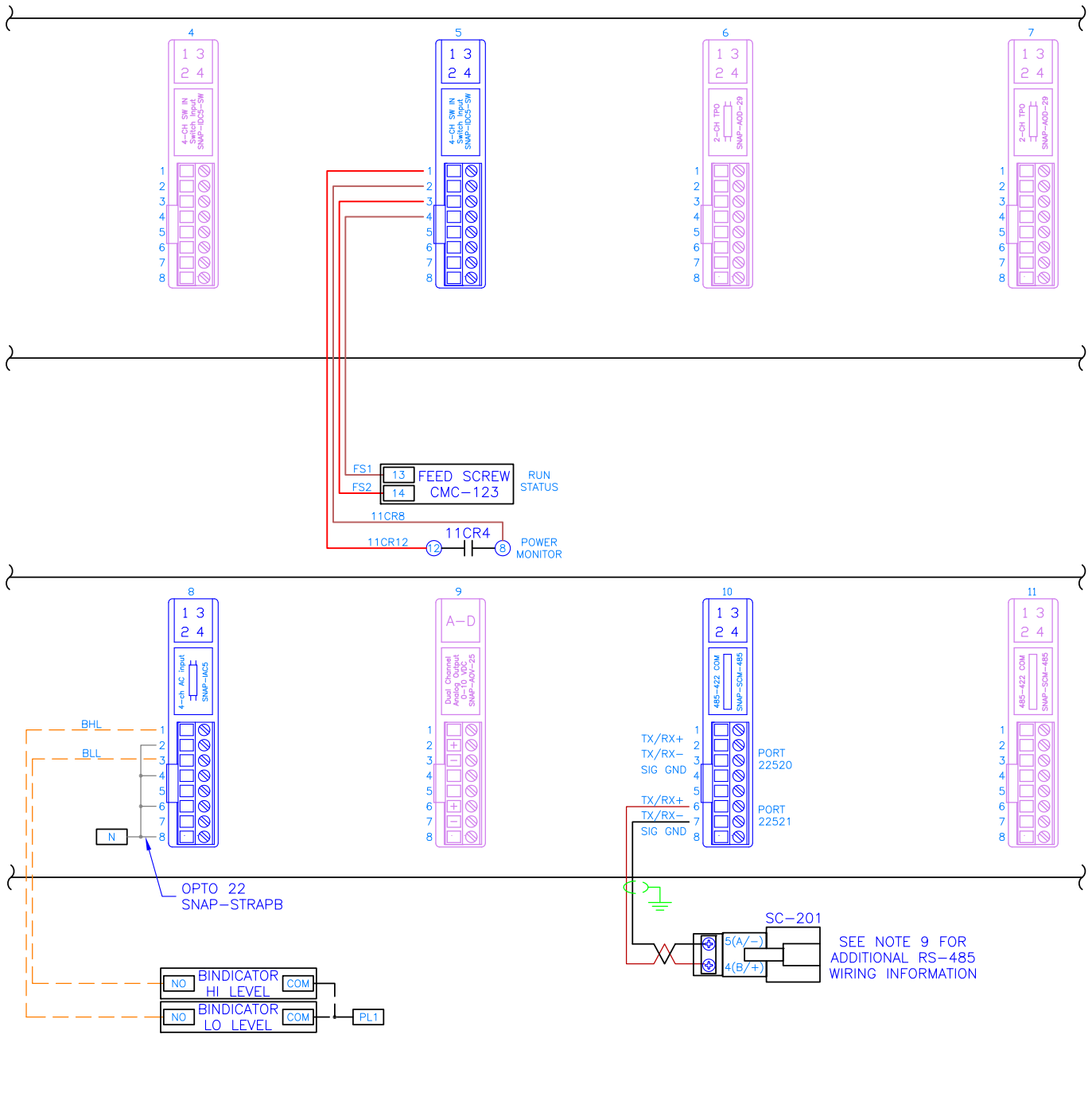
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL CTRLS SCHEMATIC

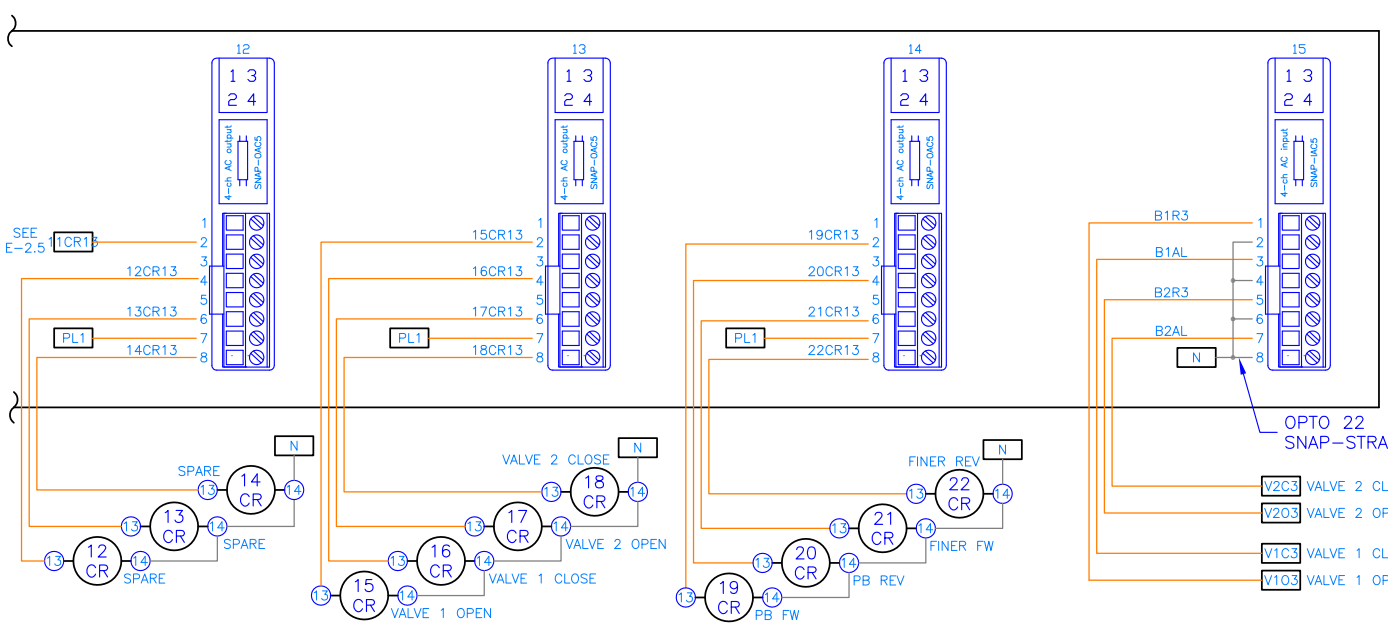
SHEET TITLE

PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-2.7

RACK 1
192.168.1.202







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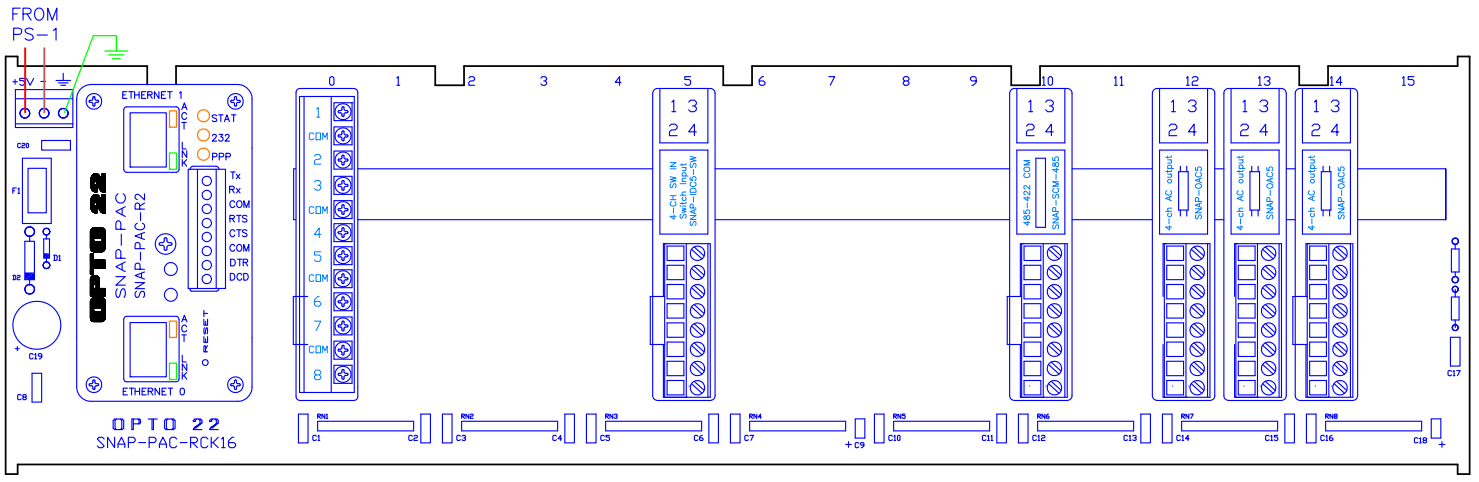
PROJECT TITLE
POWER PANEL CTRLS SCHEMATIC
TRANSPORTABLE GASIFIER
PROTECTION AGENCY
UNITED STATES ENVIRONMENTAL

SHEET TITLE

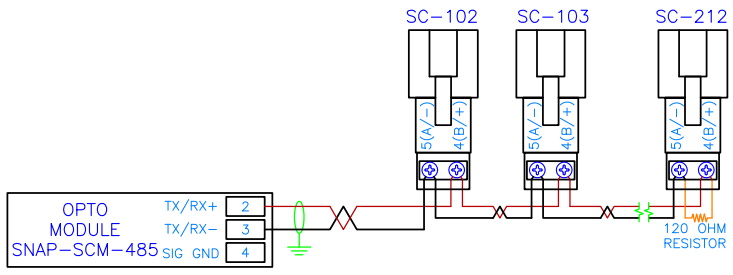
PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-2.8



VIEW OF ASSEMBLED RACK

NOTES

1. ALL SOLA POWER SUPPLIES SPECIFIED ARE UL 508 LISTED AND CLASS 2 APPROVED. PANEL BUILDER SHOULD ADD INPUT FUSES IF REQUIRED BY UL508. NOTE THAT INTERNAL INPUT FUSING IS SUPPLIED WITH UNIT - SEE SOLA MANUAL. ALL SUPPLIES ARE DIN-RAIL MOUNTABLE FROM FACTORY.
2. ASSEMBLED PANEL SHALL BE UL508 LABELED.
3. -
4. -
5. -
6. PROVIDE DIN RAIL TYPE TERMINAL BLOCKS AS NECESSARY FOR POWER DISTRIBUTION AND FUSING. PROVIDE UNUSED TERMINAL BLOCKS TO SUPPORT THE ADDITION OF ONE FUTURE 120 VAC POWER SUPPLY.
7. LEGEND
   ——— INTERNAL WIRING
   — — — FIELD WIRING
8. ALL FIELD WIRING AND INSTRUMENTS BY ARCADIS. ALL OPTO 22 HARDWARE WILL BE PROVIDED BY ARCADIS AND INSTALLED BY PANEL CONTRACTOR.
9. SPEED CONTROLLER AND SOFT STARTER RS-485 NETWORK IS SHOWN BELOW. THIS IS NOT FIELD WIRING. ARCADIS WILL PROVIDE AB RJ45 TWO-POSITION TERMINAL BLOCK ADAPTERS AK-UO-RJ45-TB2B. THESE ADAPTERS PLUG INTO THE THE RJ45 PORT ON THE DRIVES AND STARTERS TO FORM THE RS-485 NETWORK. SPLICE DRAIN WIRES AT DRIVES, BUT DO NOT CONNECT TO PE. CONNECT DRAIN TO PE NEAR OPTO SNAP-SCM-485 MODULE.



10. RELAYS 31CR, 32CR, 35CR, AND 36CR ARE 4PDT ALLEN-BRADLEY 700-HC14A1-3 WITH PUSH-TO-TEST OPTION OR EQUAL. ALL OTHER RELAYS ARE 2PDT ALLEN-BRADLEY 700-HC22A1-3 WITH PUSH-TO-TEST OPTION OR EQUAL.
11. PFANNENBERG NORMALLY OPEN TEMPERATURE CONTROL SWITCH FLZ530 17121000010. MOUNT AT OR NEAR TOP OF PANEL.

REV.	ISSUED DATE	DESCRIPTION
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PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PANEL CTRLS SCHEMATIC

SHEET TITLE

PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-2.9

0" 4" 8" 12"

1"=4"

POWER
OFF ON

SS-101
PB-24
HAND OFF AUTO

SC-102
SCREW
REV OFF FW

SC-103
PUMP
REV OFF FW

SS-104
FINER
HAND OFF AUTO
REV FW

SC-111
BIN SCREW
REV OFF FW

SC-112
BIN SCREW
REV OFF FW

CMC-121
GATE VLAVE
HAND OFF AUTO
OPEN
CLOSE
STOP

CMC-122
GATE VALVE
HAND OFF AUTO
OPEN
CLOSE
STOP

OPENED
CLOSED

CMC-123
FEED SCREW
HAND OFF AUTO

SC-211
DRAG 1
REV OFF FW

SC-212
DRAG 2
REV OFF FW

SCE

SCE

REV.	ISSUED	DATE	DESCRIPTION
1		3/6/14	ISSUED FOR REVIEW

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PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
POWER PNL PUSHBUTTON LAYOUT

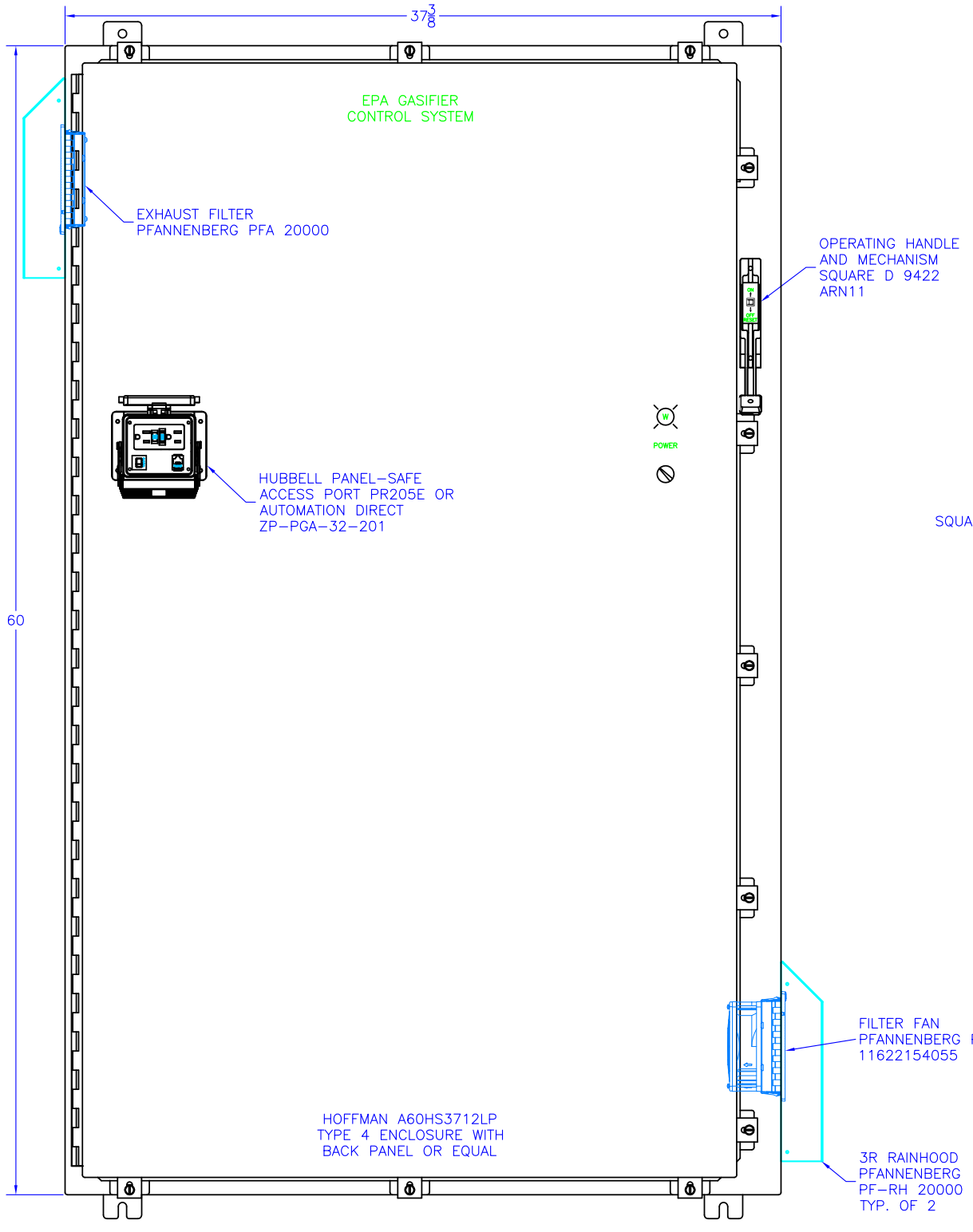
PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER **E-2.10**

NOTES

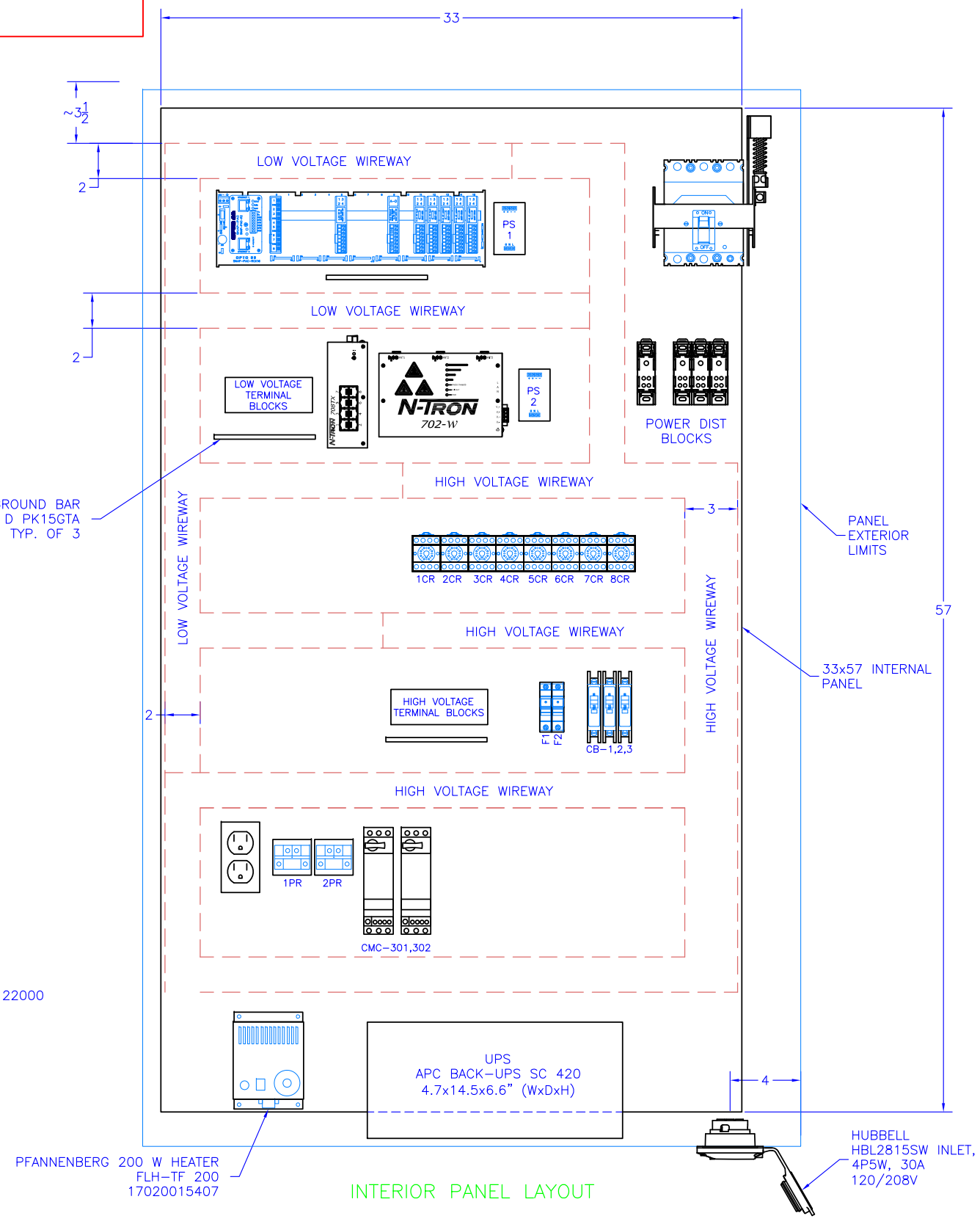
1. DIMENSIONS SHOWN ARE FOR REFERENCE PURPOSES ONLY.
2. TERMINAL BLOCKS AND WIREWAY SHOULD BE ARRANGED TO FACILITATE FIELD CONNECTIONS. ANALOG INPUT AND OUTPUT SIGNALS WILL BE ATTACHED DIRECTLY TO THE I/O MODULES.
3. COMPONENTS SHOWN ARE TO SCALE. DEVIATIONS FROM THE GENERAL ARRANGEMENT SHOWN HERE ARE SUBJECT TO APPROVAL BY ARCADIS.
4. TERMINAL BLOCKS FOR HIGH VOLTAGE (>100 VAC) FIELD WIRING MUST BE LARGE ENOUGH TO ACCEPT #14 AWG.
5. PANDUIT (WIREWAY) AS SHOWN IN DRAWING MAY PASS OVER INTERNAL PANEL MOUNTING STUDS/NUTS. CUT HOLE IN BACK OF PANDUIT TO ALLOW CLEARANCE.
6. UL 508 LISTING AND LABELING IS REQUIRED FOR THIS PANEL ASSEMBLY.
7. USE 7.5 mm HIGH DIN RAIL FOR MOUNTING OPTO SNAP RACK. (DO NOT USE ELEVATED RAIL.)

0" 8" 16" 24"

1"=8"



PANEL FRONT VIEW



INTERIOR PANEL LAYOUT

REV.	ISSUED DATE	DESCRIPTION
1	2/27/14	ISSUED FOR REVIEW

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4915 Prospectus Dr., Suite F Durham, NC
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PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
CONTROL PANEL LAYOUT

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY
00001	R. SHARPE
PROJECT NUMBER	DRAWING NUMBER
RN990274.0021	E-3.1

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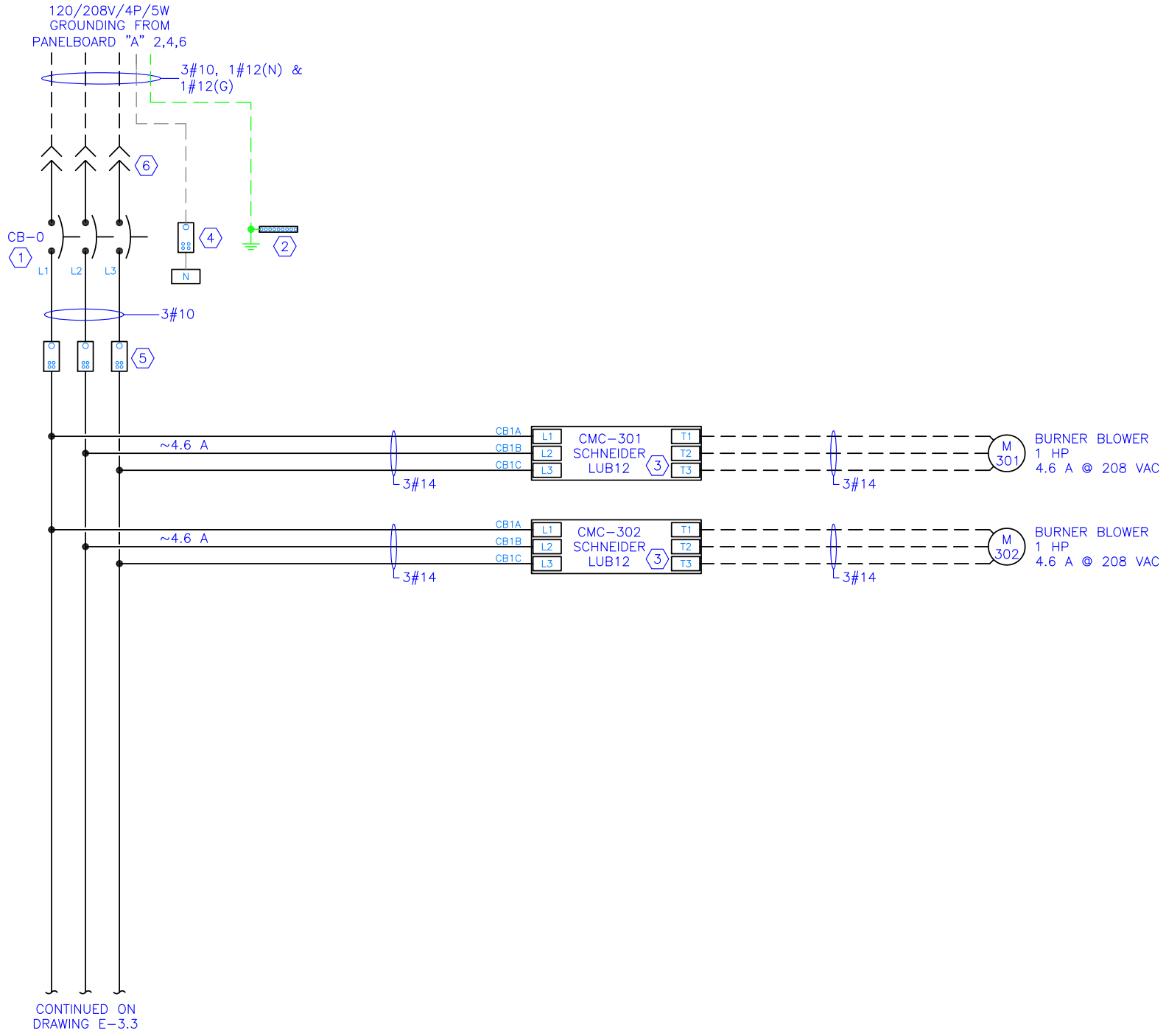

NOTES

1. MOUNT SQUARE D CABLE OPERATING MECHANISM AND TYPE A1 HANDLE (SQUARE D PART NO. 9422CSF30 FOR KIT) TO BREAKER AND PANEL DOOR.
2. UL 508 LISTING AND LABELING IS REQUIRED FOR THIS PANEL ASSEMBLY.
3. USE COOPER BUSSMANN CHCC1D TOUCH SAFE FUSE BLOCK OR EQUAL FOR ALL TYPE CC FUSES. USE COOPER BUSSMANN CHM1D TOUCH SAFE FUSE BLOCK OR EQUAL FOR ALL TYPE FWA FUSES.
4. PROVIDE COMPLETE SET OF REPLACEMENT FUSES.
5. ALL FIELD CONNECTIONS WILL BE #12 OR LESS.
6. ALL FEEDER TAP CONDUCTORS PRIOR TO OVERCURRENT DEVICE SHALL BE A MINIMUM #10 CU UNLESS OTHERWISE SPECIFIED.

LEGEND

- PANEL WIRING
- FIELD WIRING
- X — TERMINAL BLOCK
- FX — FUSE

FUSE SPECIFICATIONS

TAG	AMPS	CLASS	TYPE	MODEL
F-1	5	CC	TIME DELAY	BUSSMANN FNQ-R-5
F-2	5	CC	TIME DELAY	BUSSMANN FNQ-R-5

CIRCUIT BREAKER SPECIFICATIONS

TAG	AMPS	POLES	SC RATING	MODEL
CB-1	20	1	10kA	SQUARE D QOU120
CB-2	15	1	10kA	SQUARE D QOU115
CB-3	15	1	10kA	SQUARE D QOU115

1. 30 AMP, 10,000 AIR SQUARE D HDL36030.
2. SQUARE D GROUND BAR KIT PK15GTA. MOUNT NEAR OTHER FIELD WIRING TERMINALS, BOND TO ENCLOSURE GROUND
3. SCHNEIDER ELECTRIC COMBINATION MOTOR CONTROLLER. LUB 12 STARTER BASE WITH LUCA 05FU CONTROL UNIT AND LINE PHASE BARRIER LU9SP0.
4. BUSSMANN POWER DISTRIBUTION BLOCK PDBFS220 (1 RQD).
5. BUSSMANN POWER DISTRIBUTION BLOCK PDBFS220 (3 RQD). GANG TOGETHER WITH ACCESSORY PART 2A1279 INTERLOCKING DOVETAIL (2 RQD).
6. HUBBELL HBL2815SW TWIST-LOCK INLET, 4P5W, 30A 4P, 5-WIRE GROUNDING 120/208V. MOUNT IN BOTTOM RIGHT CORNER OF PANEL AS SHOWN IN DRAWING E-3.1.

REV.	ISSUED DATE	DESCRIPTION
1	2/26/14	ISSUED FOR REVIEW

ARCADIS
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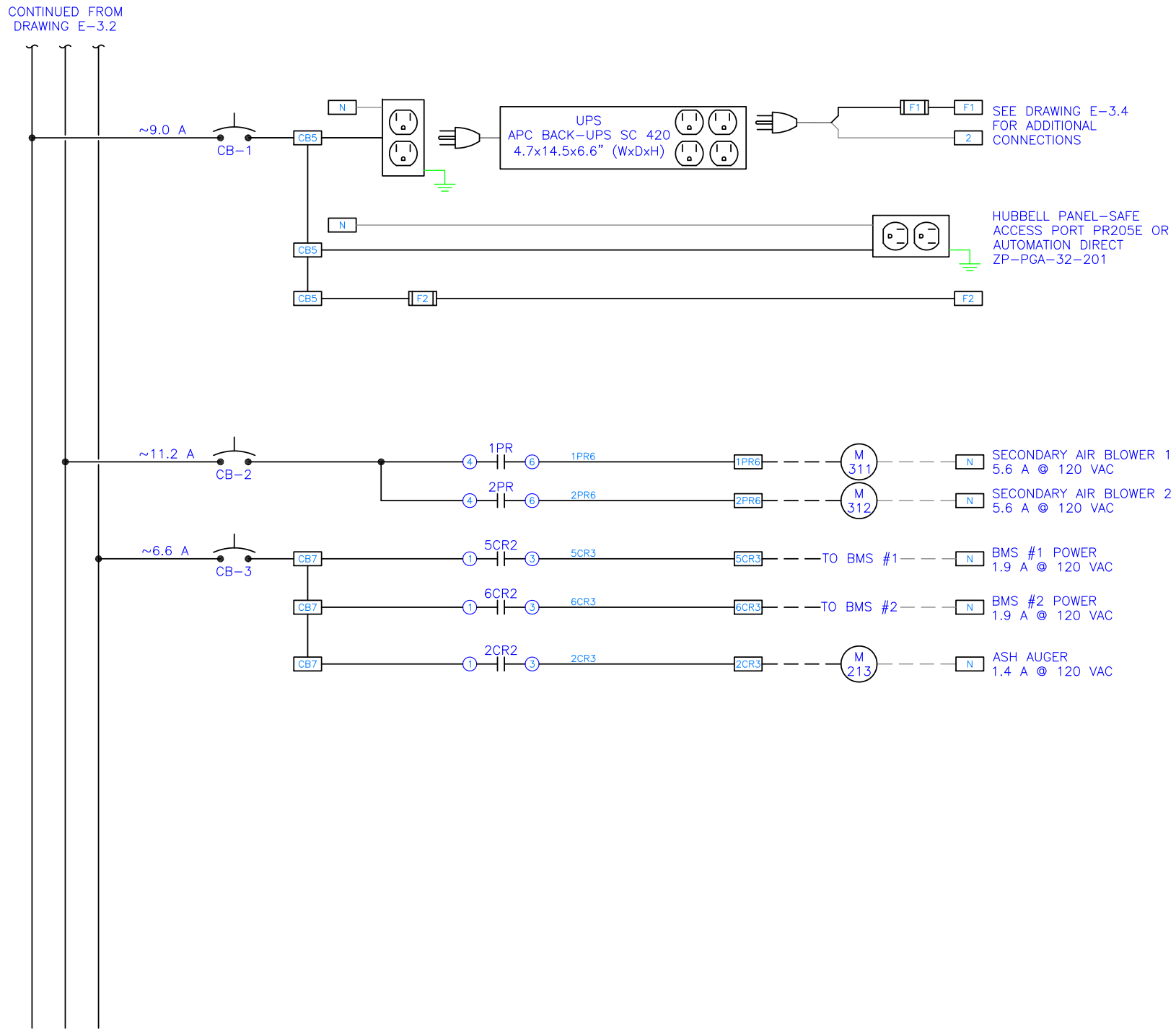
PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
CTRL PANEL PWR DISTRIBUTION

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-3.2



REV.	ISSUED DATE	DESCRIPTION
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PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY
TRANSPORTABLE GASIFIER
CTRL PANEL PWR DISTRIBUTION

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY
00001	R. SHARPE
PROJECT NUMBER	DRAWING NUMBER
RN990274.0021	**E-3.3**

POWER
OFF ON

F1
F2
F2S

FROM UPS
SEE DRAWING E-3.3

POWER

POWER DISTRIBUTION PANEL

OPTO
SNAP-PAC 1
HUBBELL PANEL-SAFE ACCESS PORT PR205E

N-TRON 708TX

SEE NOTE 9

N-TRON 702-W

CONNECT DIRECTLY TO RACK

PS-1
SOLA
SDP5-5-100T
5 V/5 A

PS-3
SOLA
SDP 2-24-100T
24 V/2.1 A

F2S
1CR2
1CR7
SEE DWG E-2.4
1 CR
N

TEMPERATURE SWITCH
SEE NOTE 11 DWG E-3.6
F2SF
M
PANEL COOLING FAN

PFANNENBERG
200 W HEATER
FLH-TF 200
17020015407

FROM BMS#1 1MA1
31 MC
#1 PRIMARY BLOWER CMC-301

FROM BMS#2 2MA1
32 MC
#2 PRIMARY BLOWER CMC-302

3CR2 3CR3 3CR1 SPARE
4CR2 4CR3 4CR1 SPARE
7CR2 7CR3 7CR1 SPARE
8CR2 8CR3 8CR1 SPARE

REV.	ISSUED DATE	DESCRIPTION
1	2/25/14	ISSUED FOR REVIEW

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC 27713 Tel: 919-544-4535 Fax: 919-544-5690
www.arcadis-us.com

PROJECT TITLE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER CONTROLS SCHEMATIC

SHEET TITLE

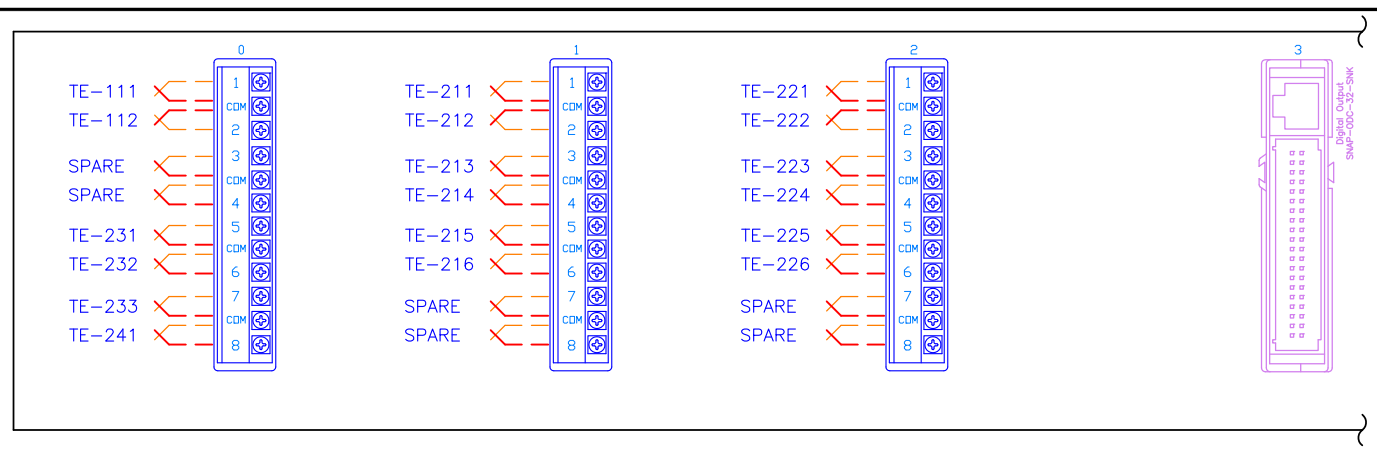
PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-3.4

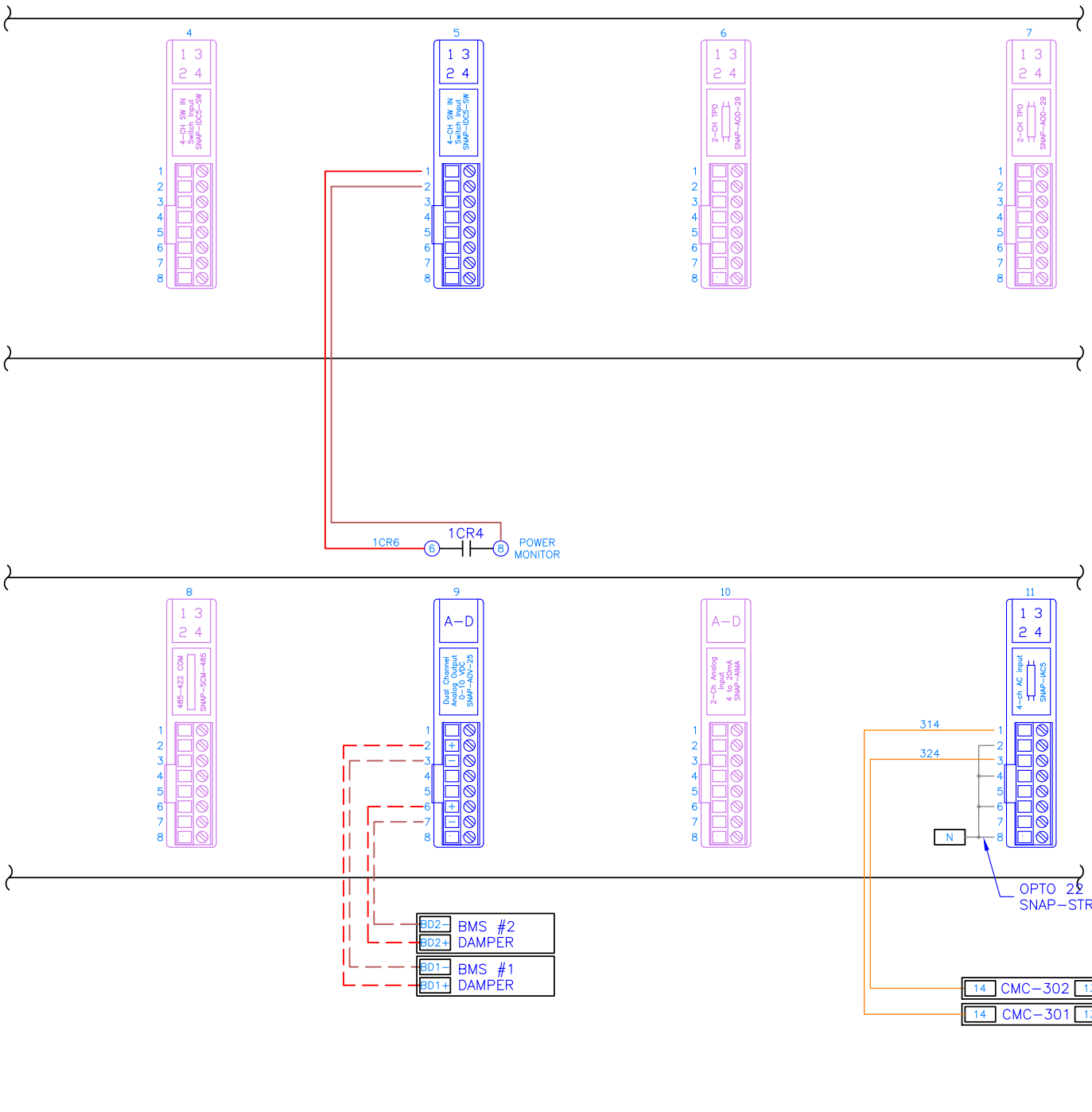
Acad Version : R19.1s (LMS Tech) Date\Time : Mon, 22 Jun 2015 - 11:43am
User Name : bsharpe Path\Name : G:\Active Projects\Environmental Monitoring & Engineering\2013 Projects\WATab-24-Gasifier\Controls\Controls.dwg
Current Plotstyle : ByColor
Layout : E-3.5

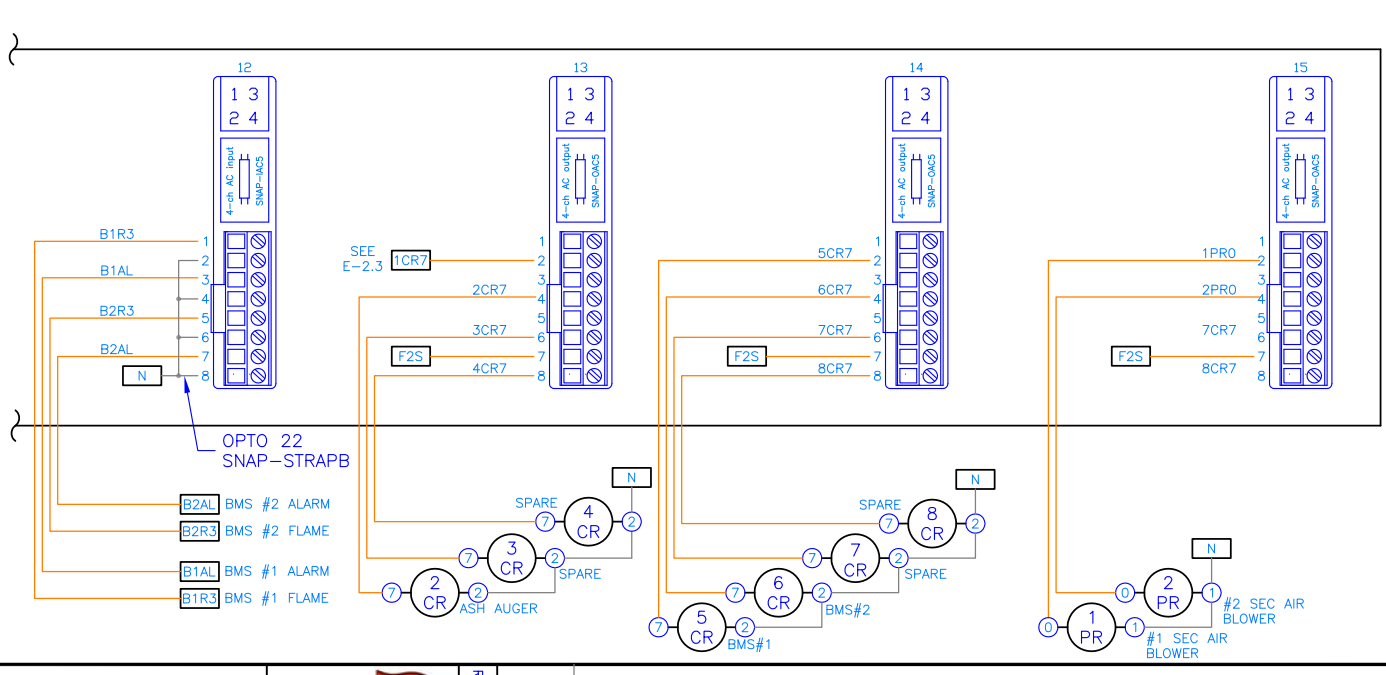
RACK 1
192.168.1.201

THERMOCOUPLES

TAG	SIDE	LOCATION
TE-111	1	SURGE BIN SCREW
TE-112	2	SURGE BIN SCREW
TE-211	1	PRIMARY CHAMBER
TE-212	1	PRIMARY CHAMBER
TE-213	1	SECONDARY CHAMBER
TE-214	1	SECONDARY CHAMBER
TE-215	1	DOWNSTREAM OF BURNER
TE-216	1	DRAG CHAIN DRIVE BOX
TE-221	2	PRIMARY CHAMBER
TE-222	2	PRIMARY CHAMBER
TE-223	2	SECONDARY CHAMBER
TE-224	2	SECONDARY CHAMBER
TE-225	2	DOWNSTREAM OF BURNER
TE-226	2	DRAG CHAIN DRIVE BOX
TE-231	N/A	ASH AUGER
TE-232	N/A	ASH AUGER EXIT
TE-233	N/A	STACK
TE-241	N/A	AMBIENT







REV.	ISSUED DATE	DESCRIPTION
1	3/5/14	ISSUED FOR REVIEW

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC
27713 Tel: 919-544-4535 Fax:
919-544-5690
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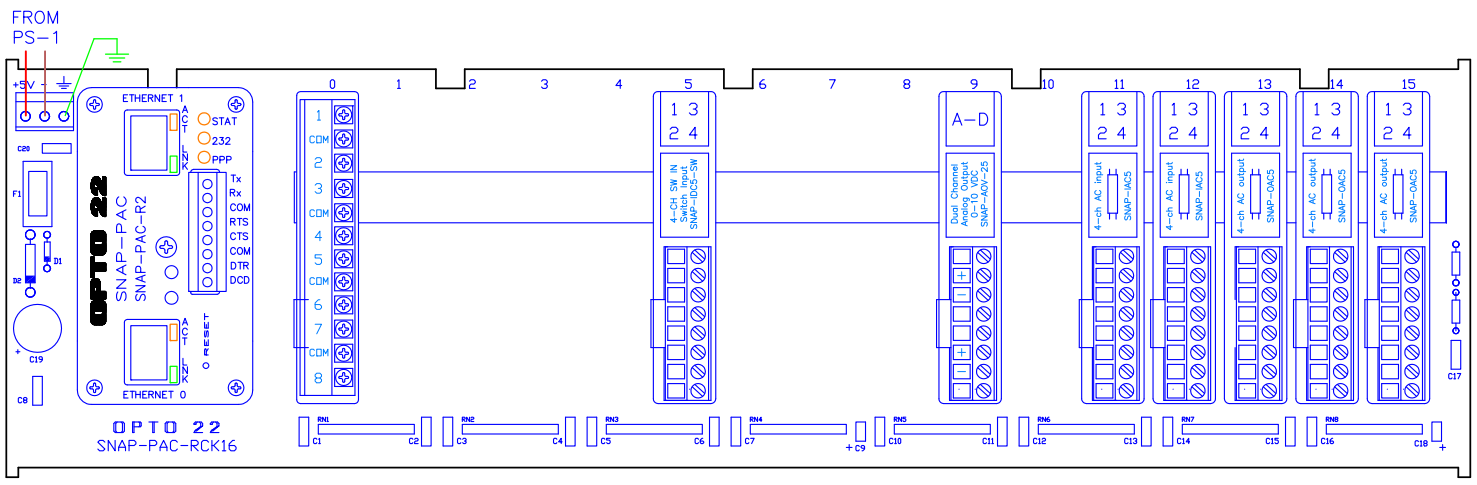
PROJECT TITLE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
CONTROLS SCHEMATIC

SHEET TITLE

PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-3.5



VIEW OF ASSEMBLED RACK

TIGHTENING TORQUE FOR SLOTTED HEAD SCREWS SMALLER THAN NO. 10, INTENDED FOR USE WITH NO. 8 AWG (8.4 mm^2) OR SMALLER CONDUCTORS. BASED ON UL485E - EQUIPMENT WIRING TERMINALS.

SLOT LENGTH OF SCREW		TIGHTENING TORQUE, POUND-INCHES (Nxm)			
		SLOT WIDTH OF SCREW, LESS THAN 0.047 INCH (1.2 mm)[C]		SLOT WIDTH OF SCREW, 0.047 INCH (1.2 mm) AND LARGER[C]	
INCH	(mm)[A,B]	A	B	A	B
LESS THAN 5/32	(4.0)	6 (0.68)	7 (0.79)	7 (0.79)	9 (1.0)
5/32 - 7/32	(4.0 - 5.6)	6 (0.68)	7 (0.79)	10 (1.1)	12 (1.4)
1/4	(6.4)	7 (0.79)	9 (1.0)	10 (1.1)	12 (1.4)
9/32	(7.1)	-----	-----	12 (1.4)	15 (1.7)
ABOVE 9/32	(7.1)	-----	-----	16 (1.8)	20 (2.3)

A FOR SLOT LENGTHS OF INTERMEDIATE VALUES, SELECT TORQUES PERTAINING TO THE NEXT SHORTER SLOT LENGTH. SLOT LENGTHS ARE MEASURED AT THE BOTTOM OF THE SLOT.

B TERMINALS HAVING DAMPING SCREWS WITH MULTIPLE TIGHTENING MEANS; FOR EXAMPLE, A HEXAGONAL HEAD SCREW, ARE TO BE TESTED USING BOTH VALUES OF TORQUE.

C SLOT WIDTH IS THE NORMAL DESIGN VALUE.

NOTES

1. ALL SOLA POWER SUPPLIES SPECIFIED ARE UL 508 LISTED AND CLASS 2 APPROVED. PANEL BUILDER SHOULD ADD INPUT FUSES IF REQUIRED BY UL508. NOTE THAT INTERNAL INPUT FUSING IS SUPPLIED WITH UNIT - SEE SOLA MANUAL. ALL SUPPLIES ARE DIN-RAIL MOUNTABLE FROM FACTORY.
2. ASSEMBLED PANEL SHALL BE UL508 LABELED.
3. CONTROL RELAYS 1CR-6CR ARE OMRON MK2PNSAC120 OCTAL BASE RELAY WITH PUSH-TO-TEST FEATURE AND INDICATION LAMP OR EQUAL.
4. POWER RELAYS 1PR-2PR CORRESPOND TO OMRON G7L-1A-BJ-CB-AC100/120. USE DIN RAIL MOUNTING ADAPTER OMRON P7LF-D AND P7LF-C COVER. INSTALL ROXBURGH XEB1201 SURGE SUPPRESSOR PARALLEL TO COIL.
5. CONNECT OPTO 22 CONTROLLER AND PANEL ACCESS PORT TO ETHERNET SWITCH USING PATCH CABLES.
6. PROVIDE DIN RAIL TYPE TERMINAL BLOCKS AS NECESSARY FOR POWER DISTRIBUTION AND FUSING. PROVIDE UNUSED TERMINAL BLOCKS TO SUPPORT THE ADDITION OF ONE FUTURE 120 VAC POWER SUPPLY.
7. LEGEND
   ——— INTERNAL WIRING
   — — — FIELD WIRING
8. ALL FIELD WIRING AND INSTRUMENTS BY ARCADIS. ALL OPTO 22 HARDWARE AND UPS (1) WILL BE PROVIDED BY ARCADIS AND INSTALLED BY PANEL CONTRACTOR. ALL OTHER HARDWARE (INCLUDING POWER SUPPLIES, ETHERNET SWITCH, AND WIRELESS RADIO) SHALL BE PROVIDED AND INSTALLED BY PANEL CONTRACTOR.
9. ANT3 WILL BE CONNECTED TO EXTERNAL FIELD MOUNTED ANTENNA. THIS WILL BE FIELD WIRING.
10. CONNECT HIGH DENSITY DIGITAL OUTPUT MODULES SNAP-ODC-32-SNK TO BREAKOUT RACKS SNAP-ODC-HDB USING SNAP-HD-BF6 HEADER CABLE (PROVIDED BY ARCADIS, INSTALLED BY FABRICATOR). RELAYS 20CR THROUGH 38 CR ARE ALLEN-BRADLEY 700-HLT1U24. USE 700-TBJ20B BLUE JUMPER LINK TO CONNECT COMMON TERMINALS OF RELAYS. USE END BARRIER 700-HN177 BETWEEN GROUPS OF 8 RELAYS. USER MARKER CARD 1492-MC6X10 FOR LABELING. MOUNT RELAYS WITH COIL CONNECTIONS UP.
11. PFANNENBERG NORMALLY OPEN TEMPERATURE CONTROL SWITCH FLZ530 17121000010. MOUNT AT OR NEAR TOP OF PANEL.

REV.	ISSUED DATE	DESCRIPTION
1	2/25/14	ISSUED FOR REVIEW

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC 27713 Tel: 919-544-4535 Fax: 919-544-5690
www.arcadis-us.com

PROJECT TITLE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER CONTROLS SCHEMATIC

SHEET TITLE

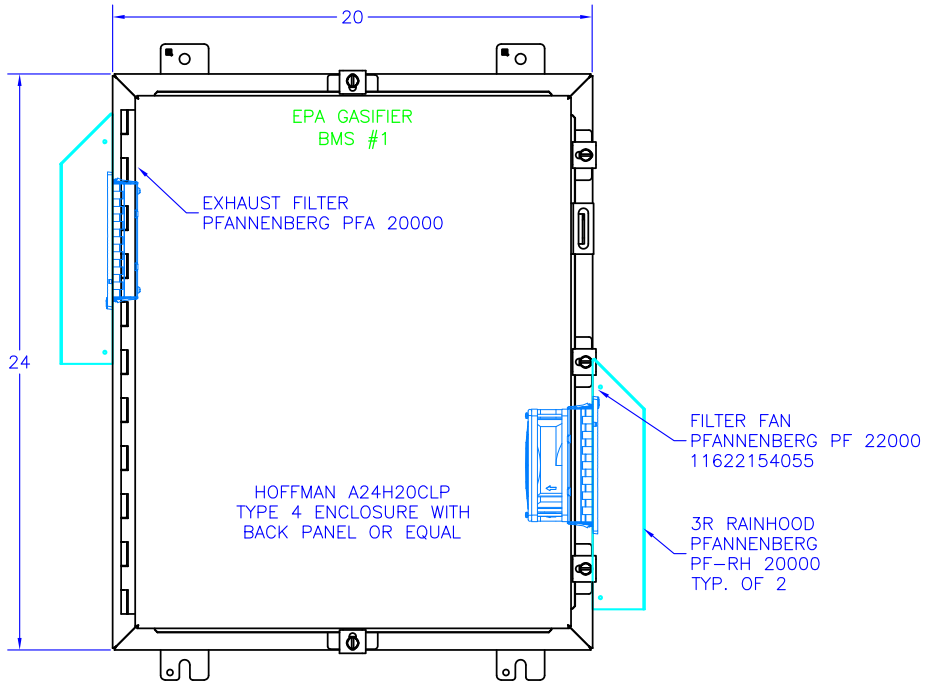
PROJECT MANAGER B. HALL	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-3.6

NOTES

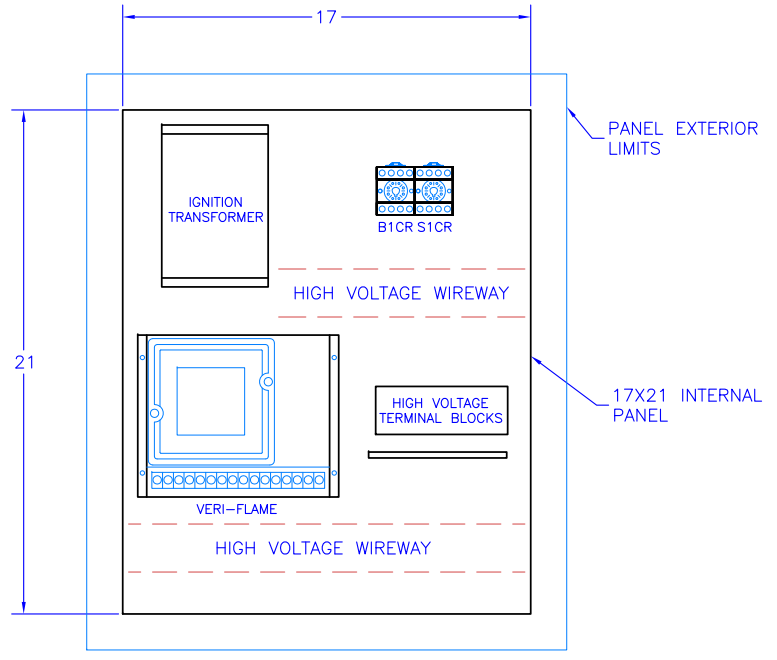
1. DIMENSIONS SHOWN ARE FOR REFERENCE PURPOSES ONLY.
2. TERMINAL BLOCKS AND WIREWAY SHOULD BE ARRANGED TO FACILITATE FIELD CONNECTIONS. ANALOG INPUT AND OUTPUT SIGNALS WILL BE ATTACHED DIRECTLY TO THE I/O MODULES.
3. COMPONENTS SHOWN ARE TO SCALE. DEVIATIONS FROM THE GENERAL ARRANGEMENT SHOWN HERE ARE SUBJECT TO APPROVAL BY ARCADIS.
4. TERMINAL BLOCKS FOR HIGH VOLTAGE (>100 VAC) FIELD WIRING MUST BE LARGE ENOUGH TO ACCEPT #14 AWG.
5. PANDUIT (WIREWAY) AS SHOWN IN DRAWING MAY PASS OVER INTERNAL PANEL MOUNTING STUDS/NUTS. CUT HOLE IN BACK OF PANDUIT TO ALLOW CLEARANCE.
6. UL 508 LISTING AND LABELING IS REQUIRED FOR THIS PANEL ASSEMBLY.
7. USE 7.5 mm HIGH DIN RAIL FOR ALL RAIL MOUNTED COMPONENTS. (DO NOT USE ELEVATED RAIL.)
8. VERI–FLAME AND IGNITION TRANSFORMER WILL BE PROVIDED BY ARCADIS AND INSTALLED BY PANEL FABRICATOR.

0' 8" 16" 24"

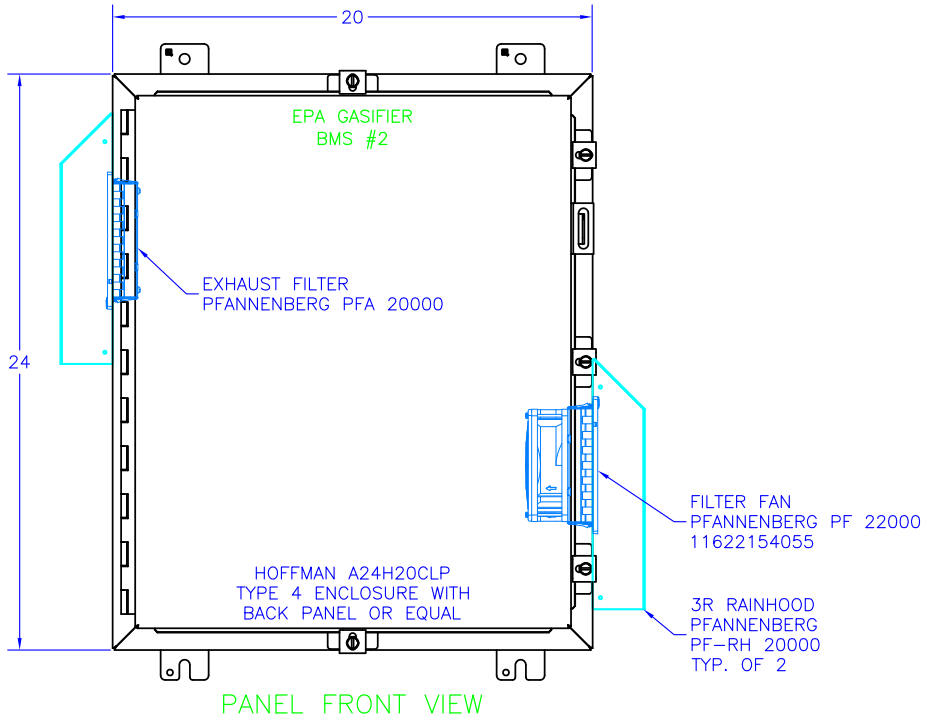
1"=8"



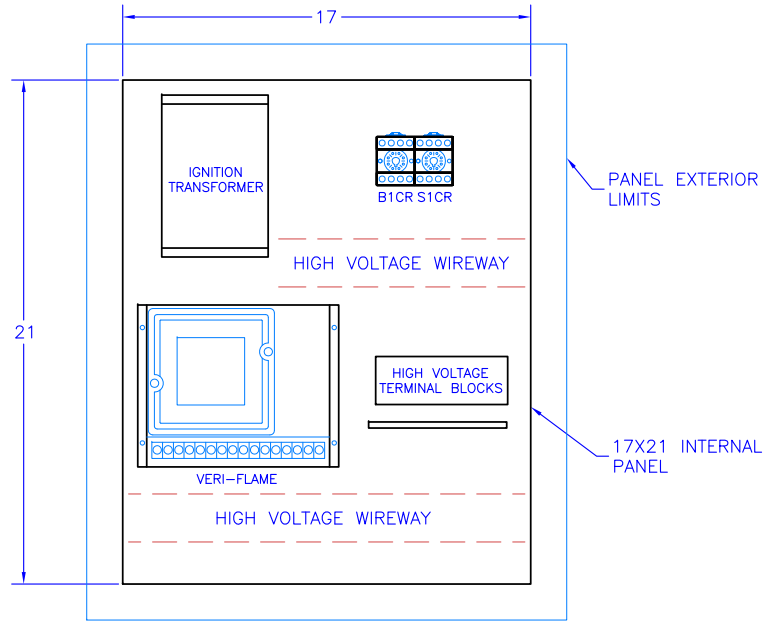
PANEL FRONT VIEW



INTERIOR PANEL LAYOUT



PANEL FRONT VIEW



INTERIOR PANEL LAYOUT

REV.	ISSUED DATE	DESCRIPTION
1	2/27/14	ISSUED FOR REVIEW

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PROJECT TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SHEET TITLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
TRANSPORTABLE GASIFIER
BURNER PANEL LAYOUT

PROJECT MANAGER	DEPARTMENT MANAGER
B. HALL	
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER 00001	DRAWN BY R. SHARPE
PROJECT NUMBER RN990274.0021	DRAWING NUMBER E-4.1

Acad Version : R19.1s (LMS Tech) Date\Time : Mon, 22 Jun 2015 - 11:50am
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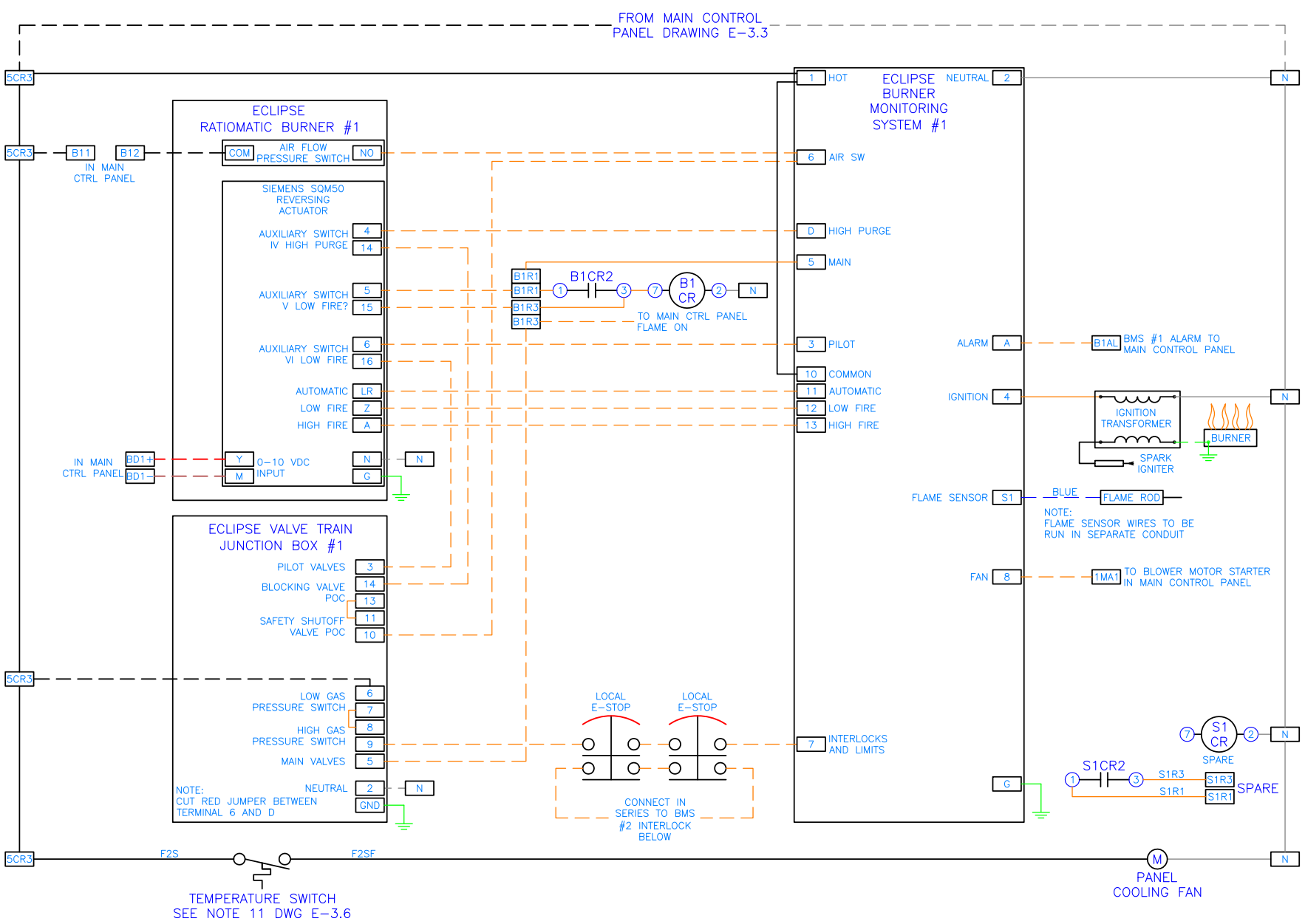
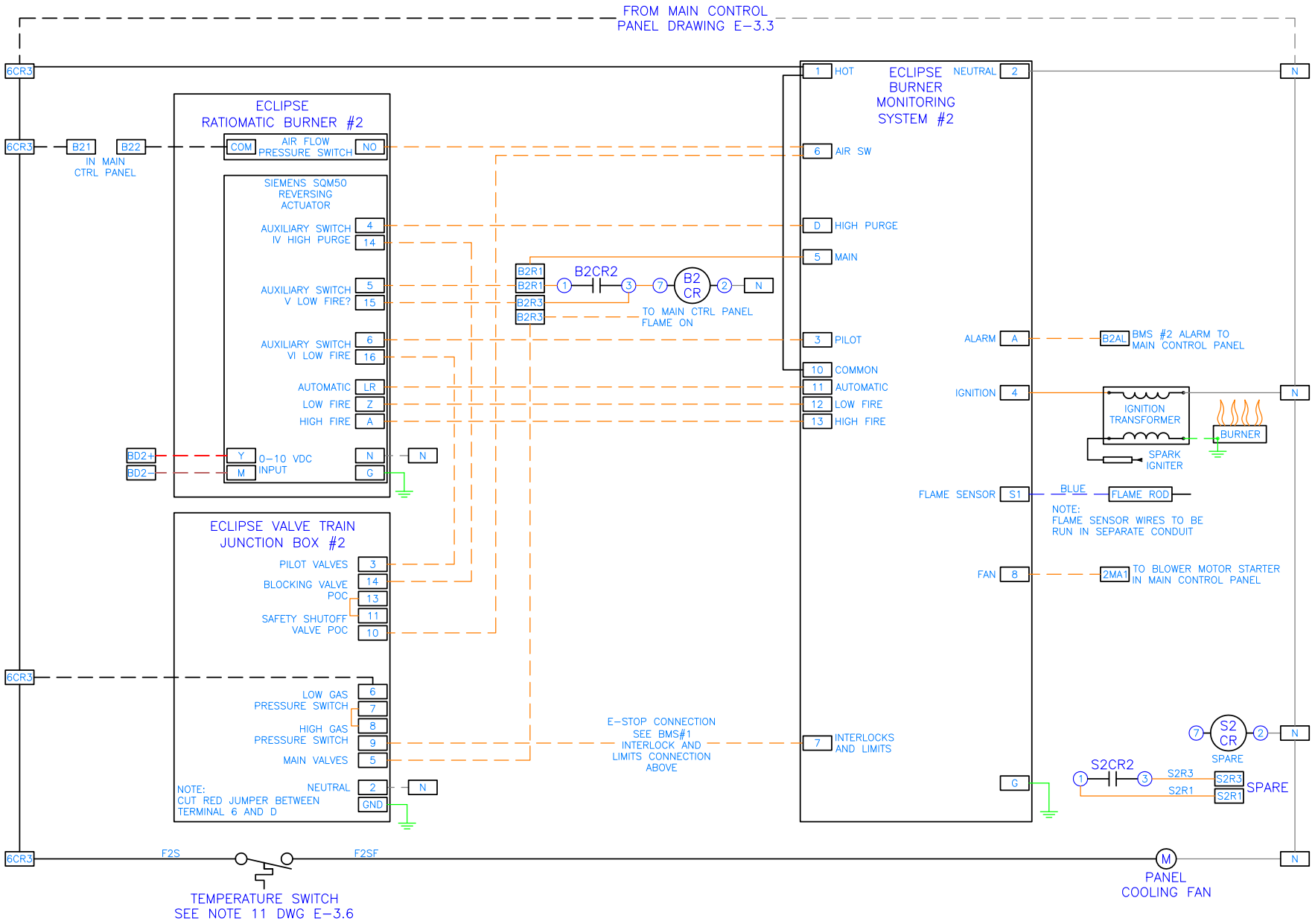
Current Plotstyle : ByColor
Layout : E-4.1



BMS #1 CONTROL PANEL SCHEMATIC



BMS #2 CONTROL PANEL SCHEMATIC

PROJECT TITLE
TRANSPORTABLE GASIFIER

SHEET TITLE
BMS CONTROLS SCHEMATIC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ARCADIS U.S., Inc.
4915 Prospectus Dr., Suite F Durham, NC 27713 Tel: 919-544-4535 Fax: 919-544-5680
www.arcadis-us.com

REV.	ISSUED DATE	DESCRIPTION
1	2/25/14	ISSUED FOR REVIEW

PROJECT MANAGER B. HALL
LEAD DESIGN PROF.
CHECKED BY
DEPARTMENT MANAGER

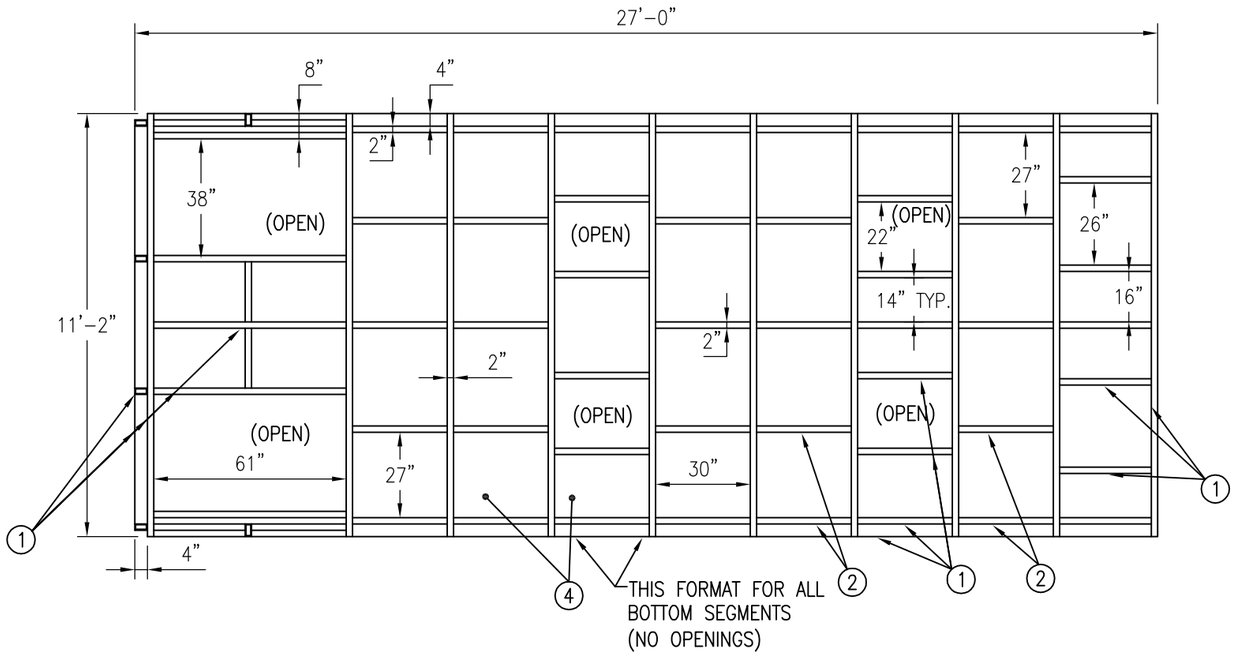
TASK/PHASE NUMBER 00001
PROJECT NUMBER RN990274.0021

DRAWN BY R. SHARPE
DRAWING NUMBER **E-4.2**

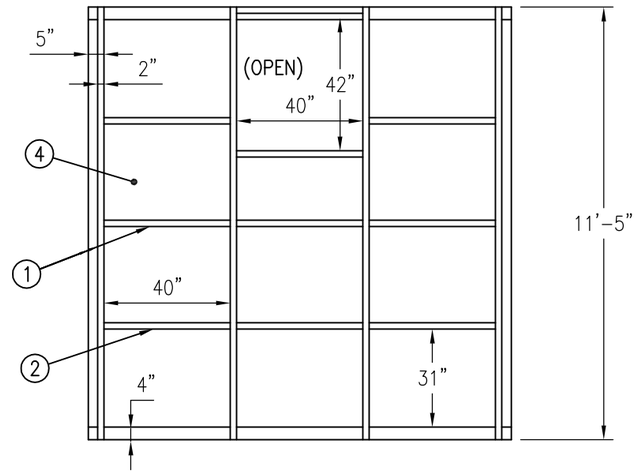
APPENDIX D: ARCADIS Design Drawings

NOTES:
1) SCALE: 1/4" = 1'
2) WELDS JOINING STRUCTURAL TO BE CONTINUOUS.
3) PLATE TO STRUCTURAL WELDS TO BE STITCHED (2"&2")

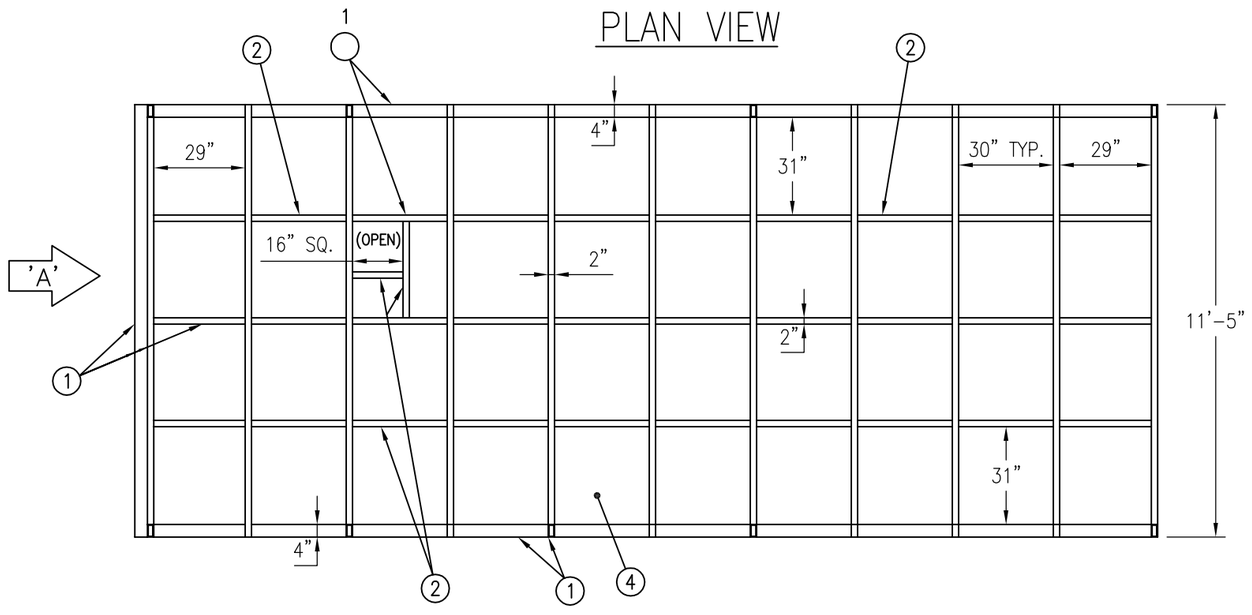
ITEM	NOTES & SPECS.
1	2"x4"x.12" M.S. RECT. TUBE
2	2"x2"x3/16" M.S. ANGLE
3	2"x4"x3/16" M.S. FLAT BAR
4	10 GA. 304 S.S PL.
5	4"x4"x3/16" S.S. < UNDER HEARTH



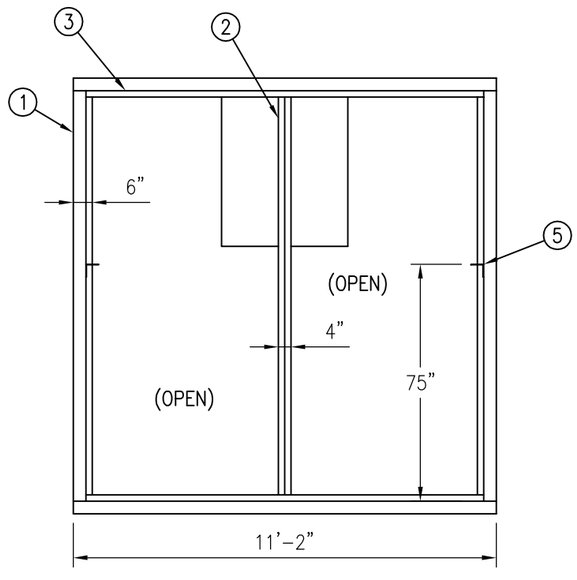
PLAN VIEW



VIEW ON 'A'



SIDE ELEVATION



FRONT VIEW

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED STEEL SHELL DETAILS, DWG. NO. 276-D DRAWN BY D. BROOKS DATED AUG. 16, 2006.

REV.	ISSUED DATE	DESCRIPTION

ARCADIS
ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Drive, Suite 300
Raleigh, NC 27607
Tel: 919-854-1282 Fax: 919-854-5448
www.arcadis-us.com
License Number C-1869

PROJECT TITLE

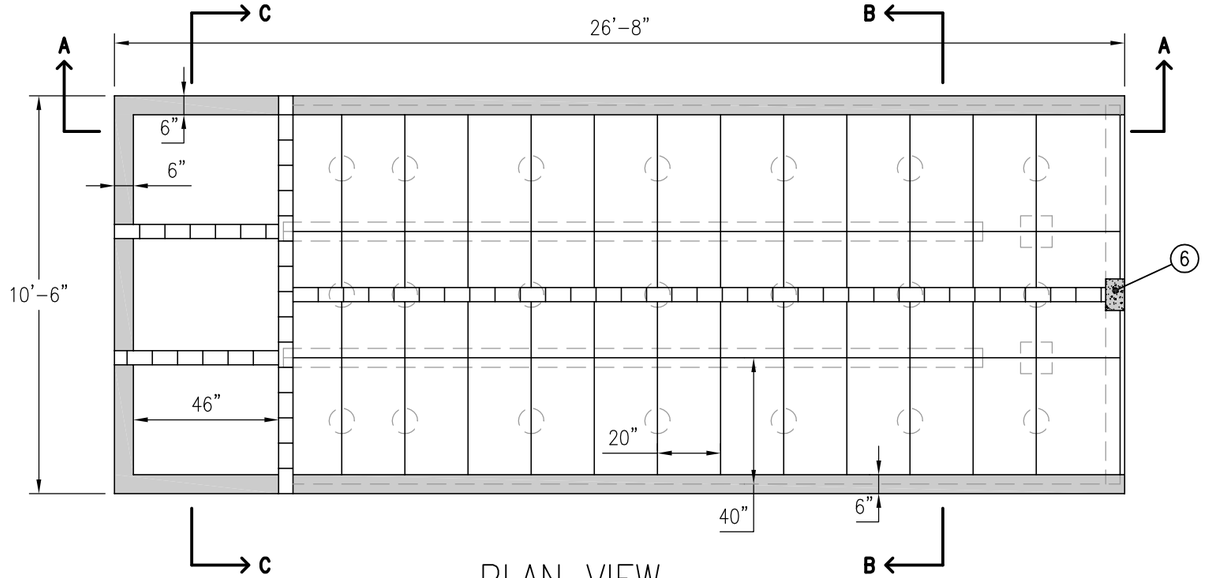
SHEET TITLE

Steel Shell Details 276-D

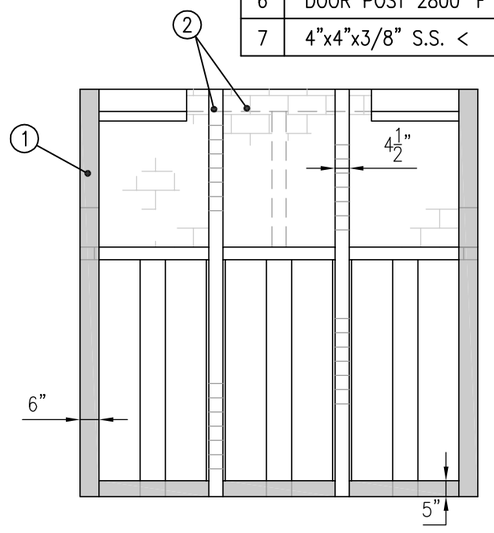
PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-3

NOTES:
1) SCALE: 1/4" = 1'

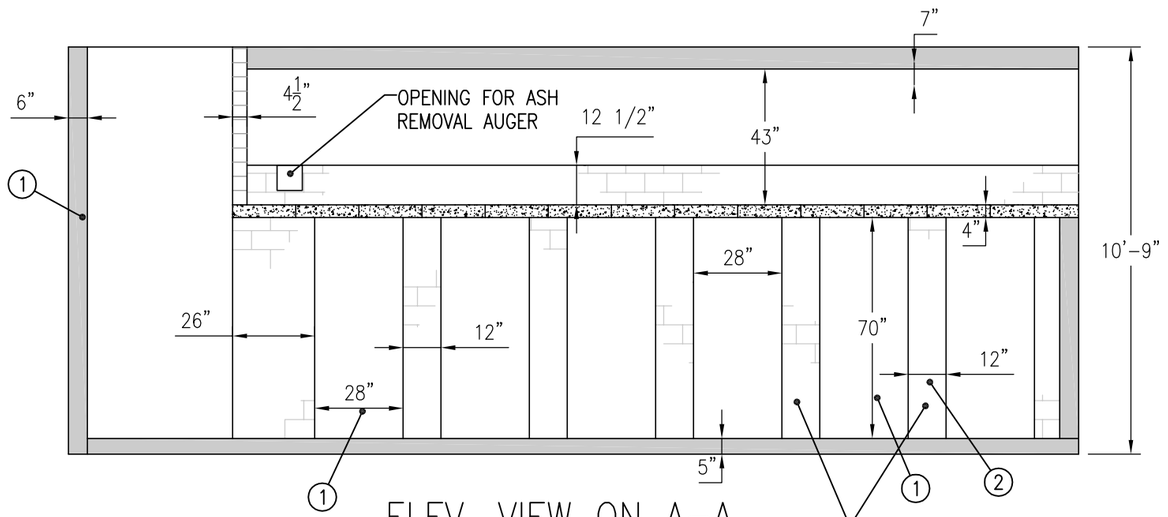
ITEM	NOTES & SPECS.
1	2600° F CER. MODULES (SERPENTIN) 10 LF/FT^3
2	2600° F INS. FIRE BRICK
3	HEARTH MTL. 3000° F CASTABLE
4	1400° F INS. BOARD
5	COLUMNAR PIERS 2600° F MW CAST.
6	DOOR POST 2800° F CASTABLE
7	4"x4"x3/8" S.S. <



PLAN VIEW

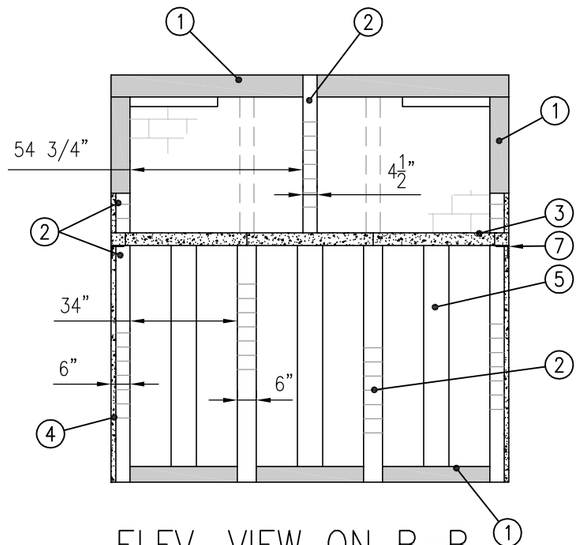


ELEV. VIEW C-C



ELEV. VIEW ON A-A

ALTERNATE CONSTRUCTION; USE (1) THROUGH THE SEC. CH. OUTSIDE WALL IN CONJUNCTION WITH (7)



ELEV. VIEW ON B-B

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED STEEL SHELL REFRACTORY DETAILS, DWG. NO. 277-D DRAWN BY D. BROOKS DATED AUG. 28, 2006.

REV. ISSUED DATE DESCRIPTION

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Raleigh, NC 27607
Tel: 919-854-1282 Fax: 919-854-5448
www.arcadis-us.com
License Number C-1869

PROJECT TITLE

SHEET TITLE

Steel Shell Refractory Details
277-D

PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-4

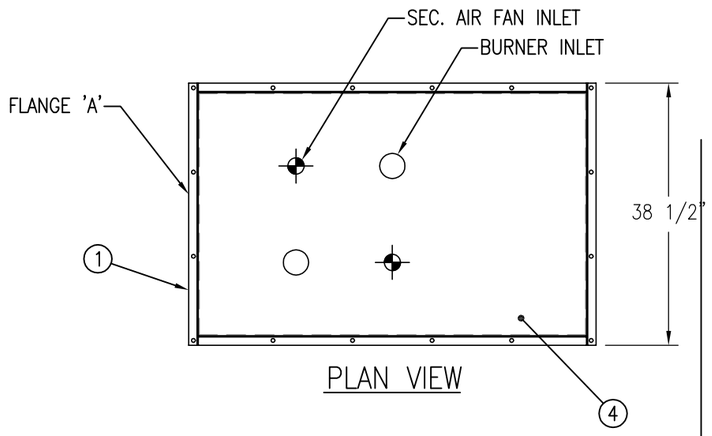
Acad Version : R18.1s (LMS Tech)
User Name : alynch
Date\Time : Tue, 31 Jan 2012 - 9:27am
Path\Name : C:\Users\alynch\Desktop\CAD DETAILS\2-4 - Steel Shell Refractory Details 277-D.dwg
Current Plotstyle : ByLayer
Layout Tab: 2-4

NOTES:

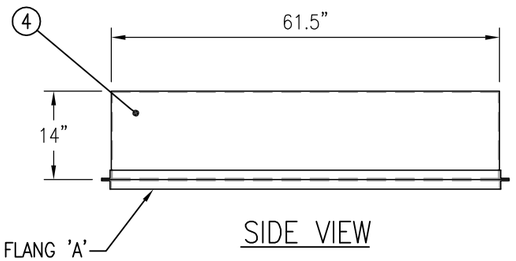
ORIGINAL DRAWING BY DRB TECH. TITLED DOORS, TRANS-DUCT, FRONT PLATES. DWG. NO. 278-D DRAWN BY D. BROOKS DATED SEPT. 1, 2006.

TRANS DUCT

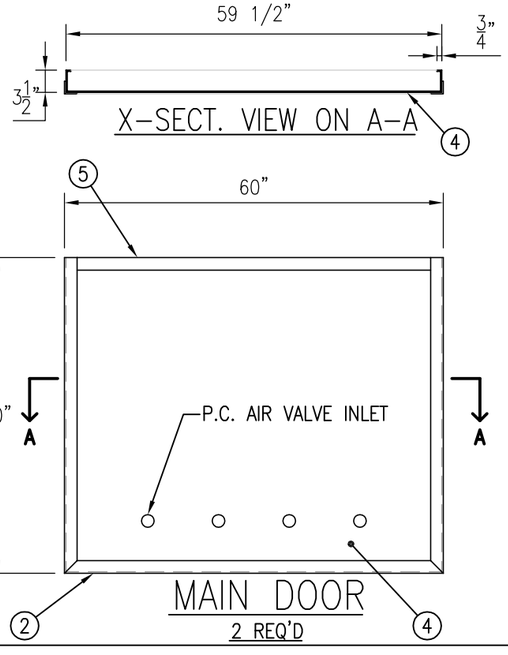
2 REQ'D



PLAN VIEW



SIDE VIEW



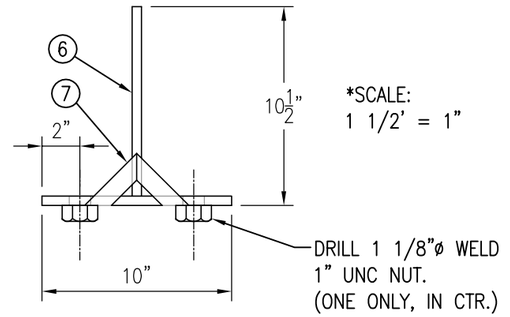
X-SECT. VIEW ON A-A

MAIN DOOR

2 REQ'D

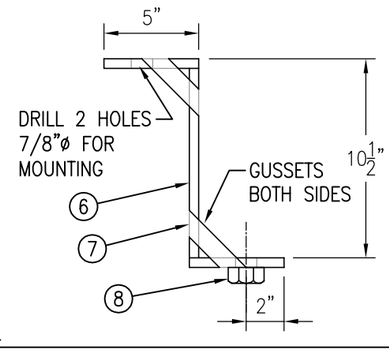
MIDDLE DOOR LATCH

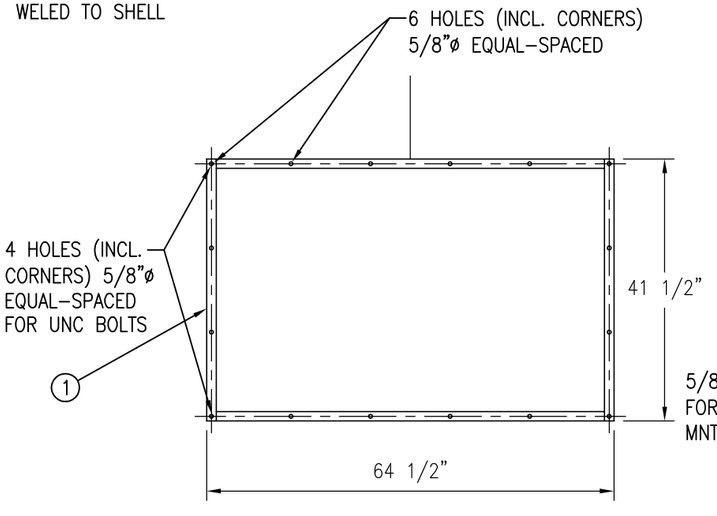
1 REQ'D



SIDE DOOR LATCHES

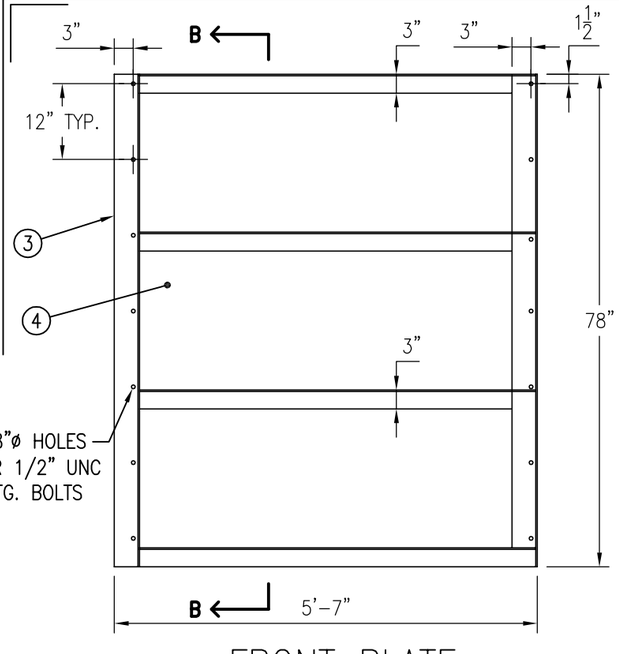
2 REQ'D





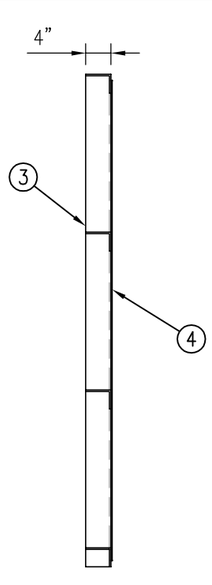
FLANGE 'A'

4 REQ'D



FRONT PLATE

ONE LEFT HAND - ONE RIGHT HAND



X-SECT. VIEW ON B-B

NOTES:

1) SCALE: 1/2' = 1"
2) WELDS JOINING STRUCTURAL TO BE CONTINUOUS.
3) PLATE TO STRUCTURAL WELDS TO BE STITCHED (2"&2").

ITEM	NOTES & SPECS.
1	1 1/2"x1 1/2"x3/16" M.S. ANGLE
2	2"x2"x1/4" M.S. ANGLE
3	3"x4"x1/4" M.S. ANGLE
4	10 GA. 304 S.S. PL.
5	2"x1/4" M.S. FLAT BAR
6	4"x1/2" M.S. FLAT BAR
7	1"x1/4" M.S. FLAT BAR
8	1" UNC NUT

REV. ISSUED DATE DESCRIPTION

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801 Corporate Center Drive, Suite 300
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Tel: 919-854-1282 Fax: 919-854-5448
www.arcadis-us.com
License Number C-1869

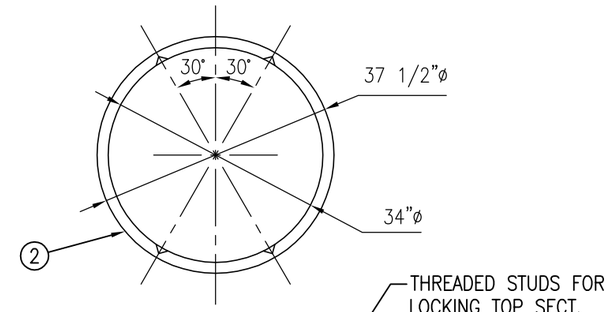
PROJECT TITLE

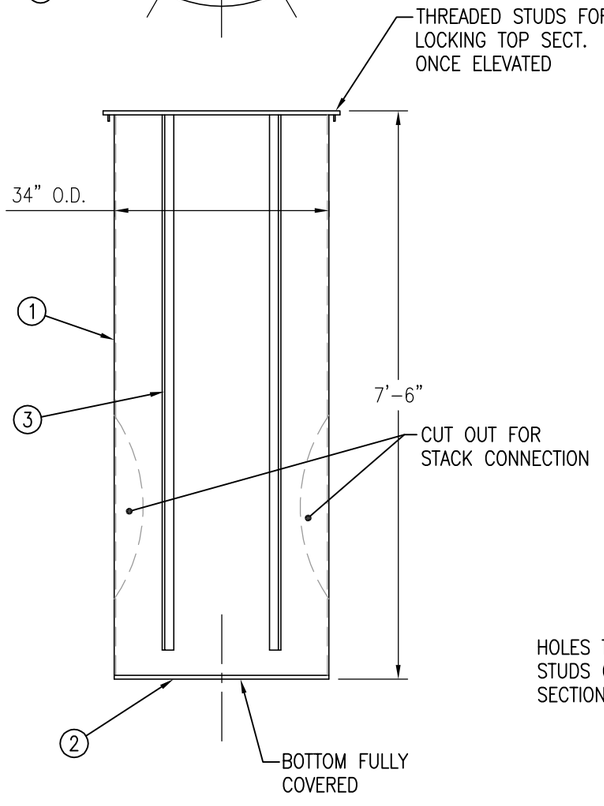
SHEET TITLE

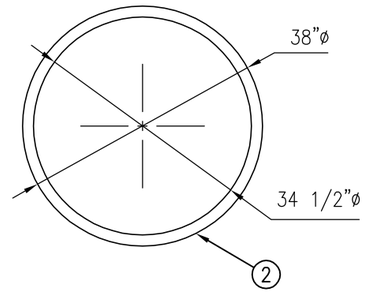
Doors, Transition Duct Front Plates 278-D

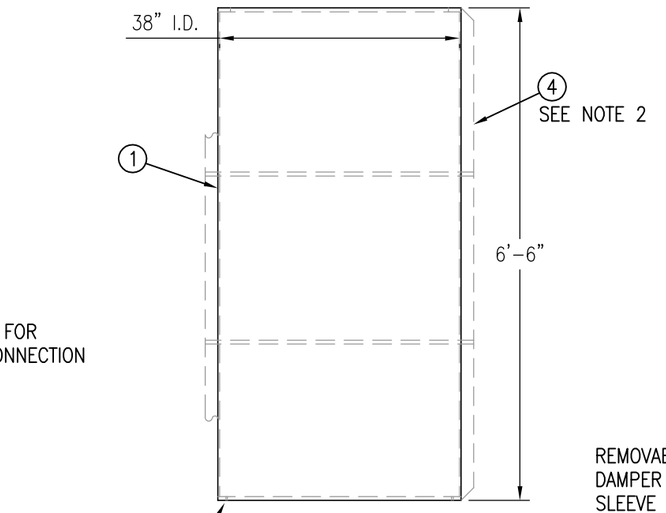
PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-5

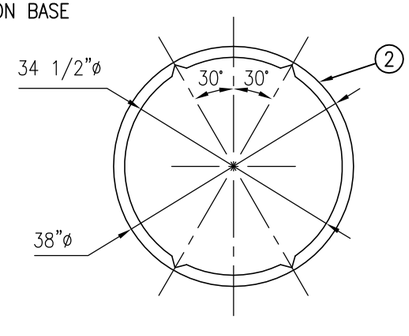
Acad Version : R18.1s (LMS Tech)
User Name : alynch
Date\Time : Tue, 31 Jan 2012 - 9:28am
Path\Name : C:\Users\alynch\Desktop\CAD DETAILS\2-5 - Doors, Transition Duct Front Plates 278-D.dwg
Current Plotstyle : ByLayer
Layout Tab: 2-5



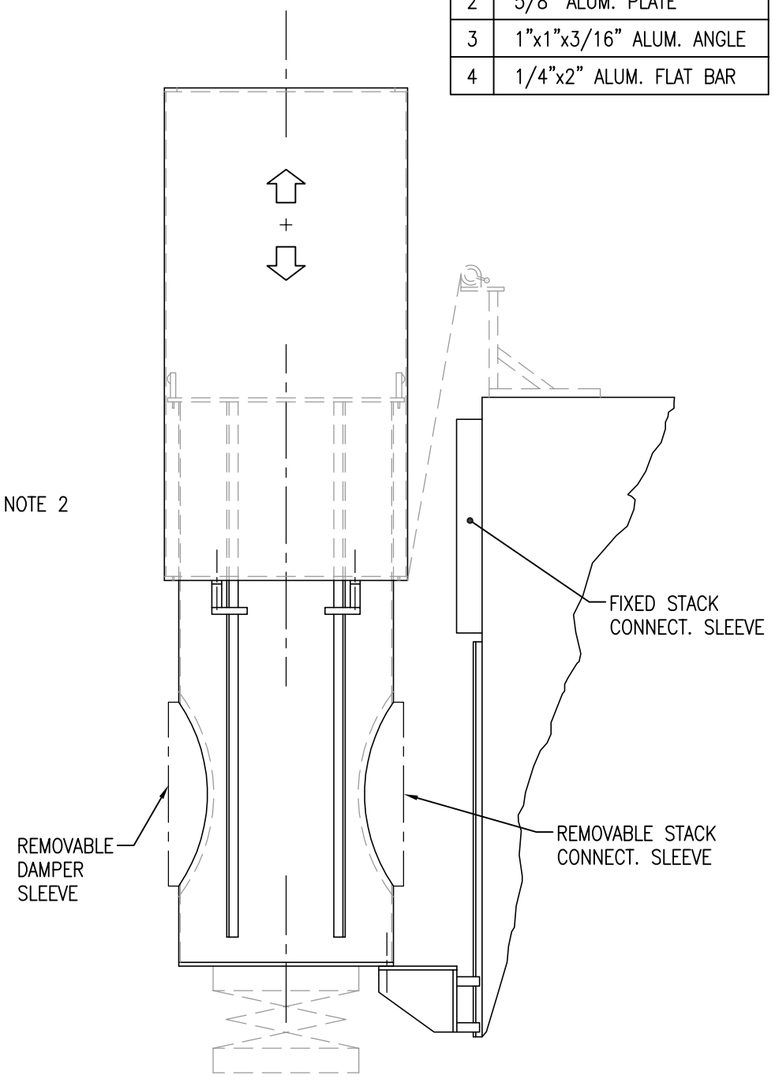








REMOVABLE BOTTOM FLANGE NOTCHED TO CLEAR ANGLE V-WHEEL RAILS



NOTES:
1) SCALE: 1/2" = 1'
2) RIGIDIZE OUTER SECTION WITH FLAT BAR STIFFENERS TO SUIT

ITEM	NOTES & SPECS.
1	1/4" ALUM. SHEET
2	5/8" ALUM. PLATE
3	1"x1"x3/16" ALUM. ANGLE
4	1/4"x2" ALUM. FLAT BAR

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED TELESCOPING STACK SYSTEM, DWG. NO. 279-D DRAWN BY D. BROOKS DATED SEPT. 9, 2006.

REV. ISSUED DATE DESCRIPTION

ARCADIS

ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Drive, Suite 300
Raleigh, NC 27607
Tel: 919-854-1282 Fax: 919-854-5448
www.arcadis-us.com
License Number C-1869

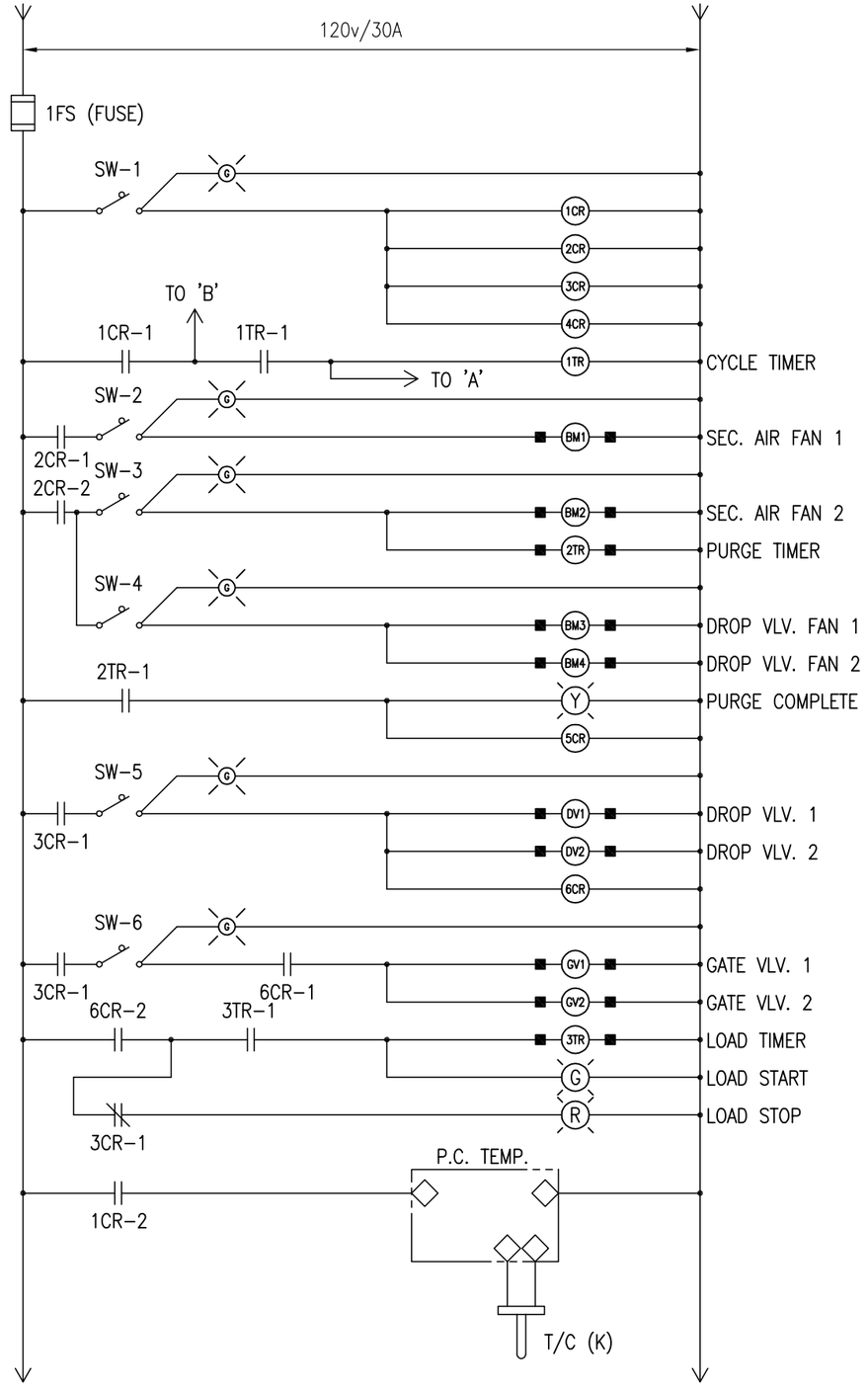
PROJECT TITLE

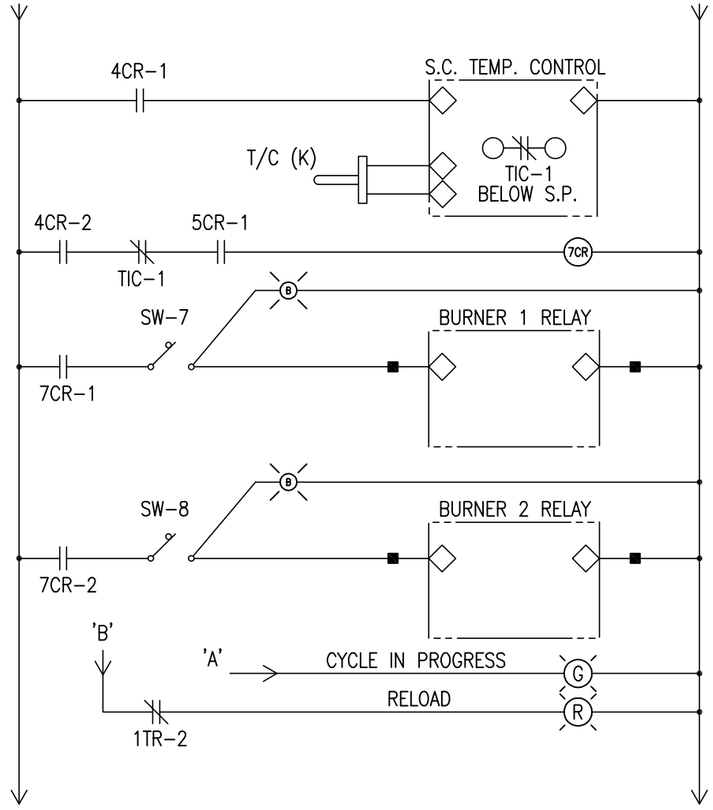
SHEET TITLE

Telescoping Stack 279-D

PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-6

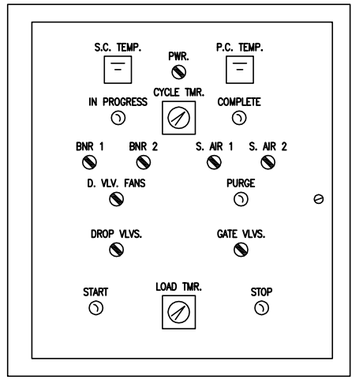
Acad Version : R18.1s (LMS Tech)
User Name : dlynch
Date\Time : Tue, 31 Jan 2012 - 9:29am
Path\Name : C:\Users\dlynch\Desktop\CAD DETAILS\2-6 - Telescoping Stack 279-D.dwg
Current Plotstyle : ByLayer
Layout Tab: 2-6



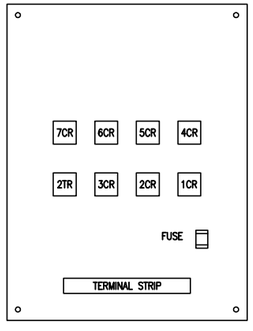


NOTES:

1) RELAY (CR) SHOWN UNPOWERED.
2) ■ INDICATES POINTS ON TERM. STRIP.
3) T/C INDICATES THERMOCOUPLE.



PANEL FACE



INTERNAL LAYOUT

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED ELECTRICAL SCHEMATIC, DWG. NO. 281-D DRAWN BY D. BROOKS DATED OCT. 7, 2006.

REV.	ISSUED DATE	DESCRIPTION

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Raleigh, NC 27607
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www.arcadis-us.com
License Number C-1869

PROJECT TITLE

SHEET TITLE

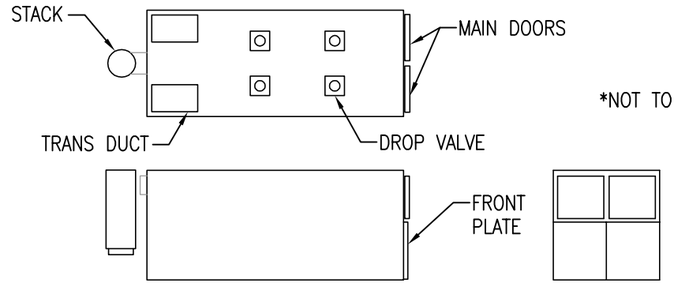
Electrical Diagram 281-D

PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-7

NOTES:
1) SCALE: 1/4" = 1'
2) PARTS FOR MTG. ON TOP OF UNIT TO BE LIFTED INTO PLACE USING SCISSORS LIFTS & ROLLER BEDS.
3) EST. PAYLOAD ON TRAILER IS 60,000 LBS.

PLAN VIEW

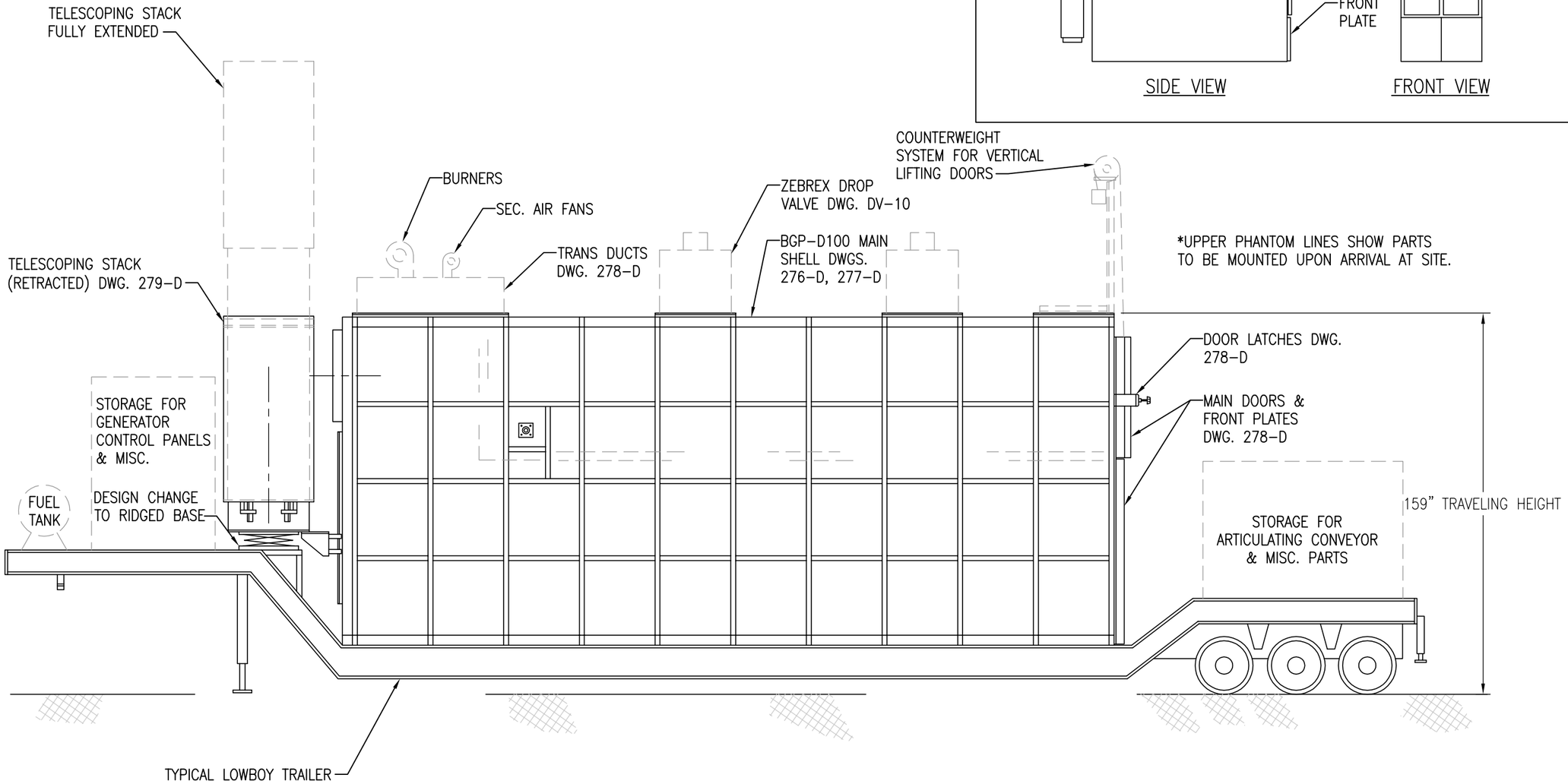
BGP-D1000 "KEY SKETCH



*NOT TO SCALE

SIDE VIEW

FRONT VIEW



SIDE ELEVATION VIEW

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED BASIC ARRANGEMENT, DWG. NO. 282-D DRAWN BY D. BROOKS DATED SEPT. 12, 2006.

REV. ISSUED DATE DESCRIPTION

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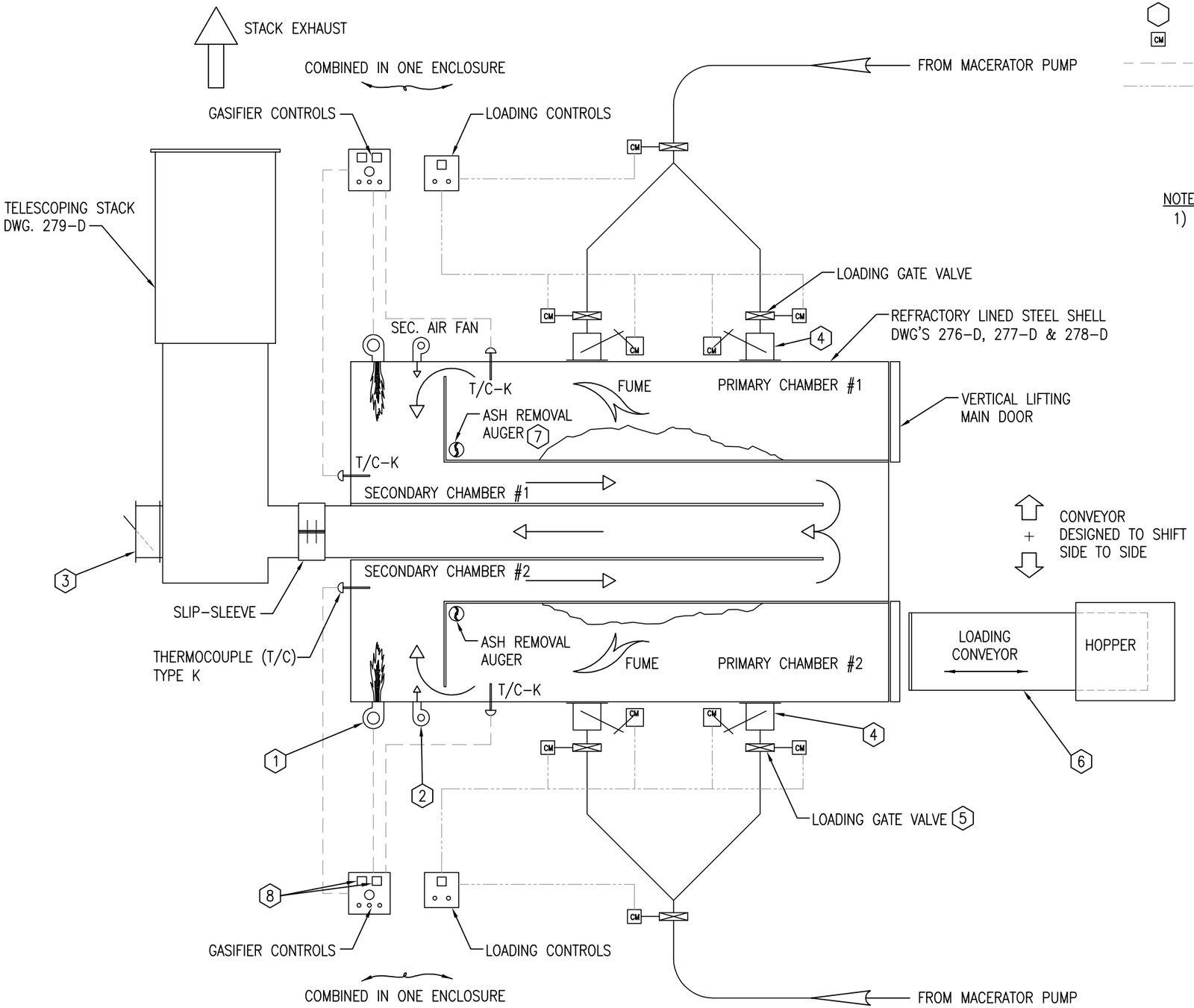
www.arcadis-us.com
License Number C-1869

PROJECT TITLE

SHEET TITLE

Basic Arrangement 282-D

PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-8



LEGEND

- ITEM ON PRIMARY MATERIALS LIST
- CM — CONTROL MOTOR
- CONTROL SIGNAL FOR BURNERS
- CONTROL SIGNAL FOR LOADING VALVES

NOTES:

1) NOT TO SCALE

NOTES:

ORIGINAL DRAWING BY DRB TECH. TITLED PROCESS AND INSTRUMENTATION DIAGRAM, DWG. NO. 283-D DRAWN BY D. BROOKS DATED NOV. 6, 2006.

REV. ISSUED DATE DESCRIPTION

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www.arcadis-us.com
License Number C-1869

PROJECT TITLE

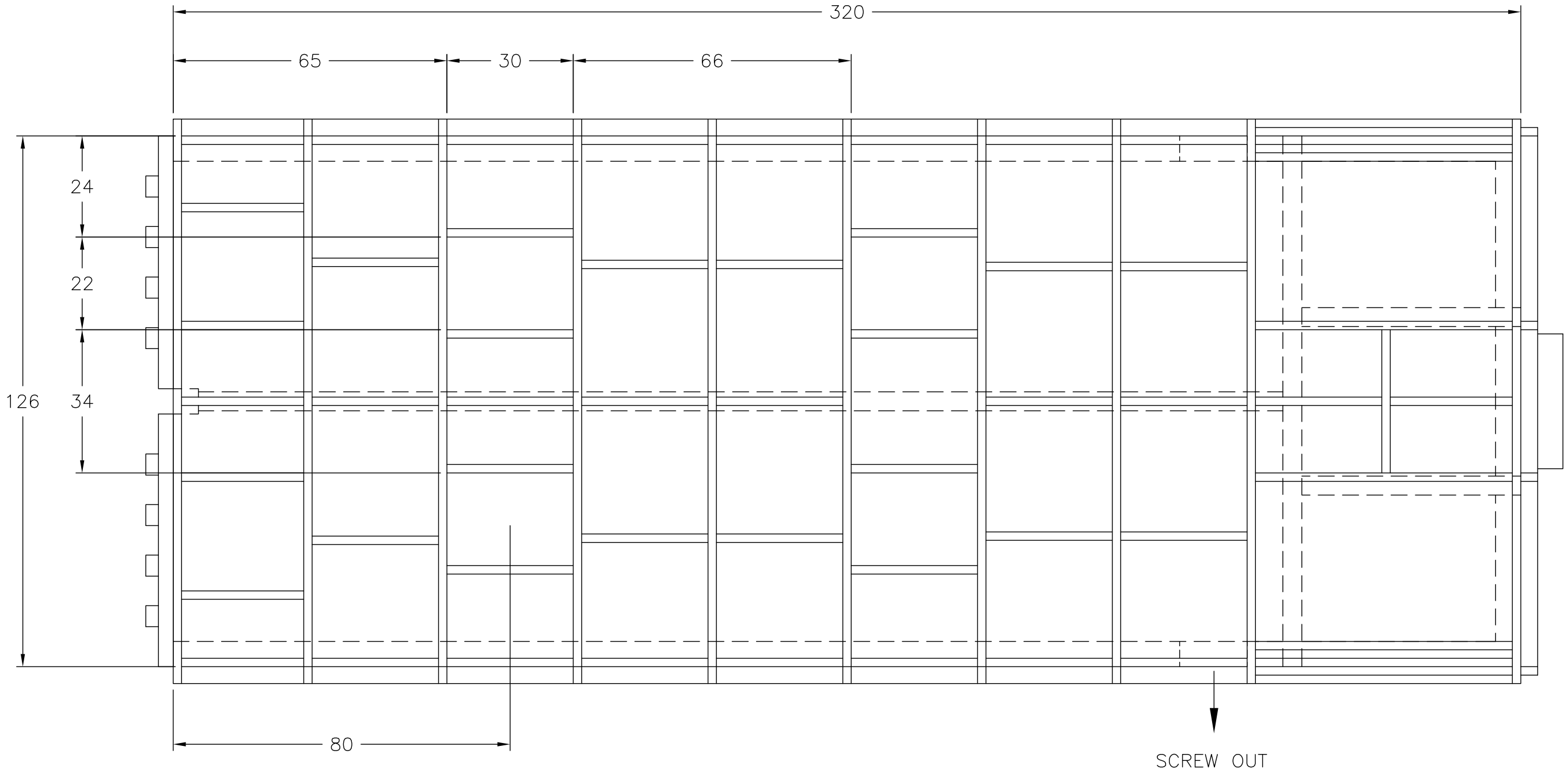
SHEET TITLE

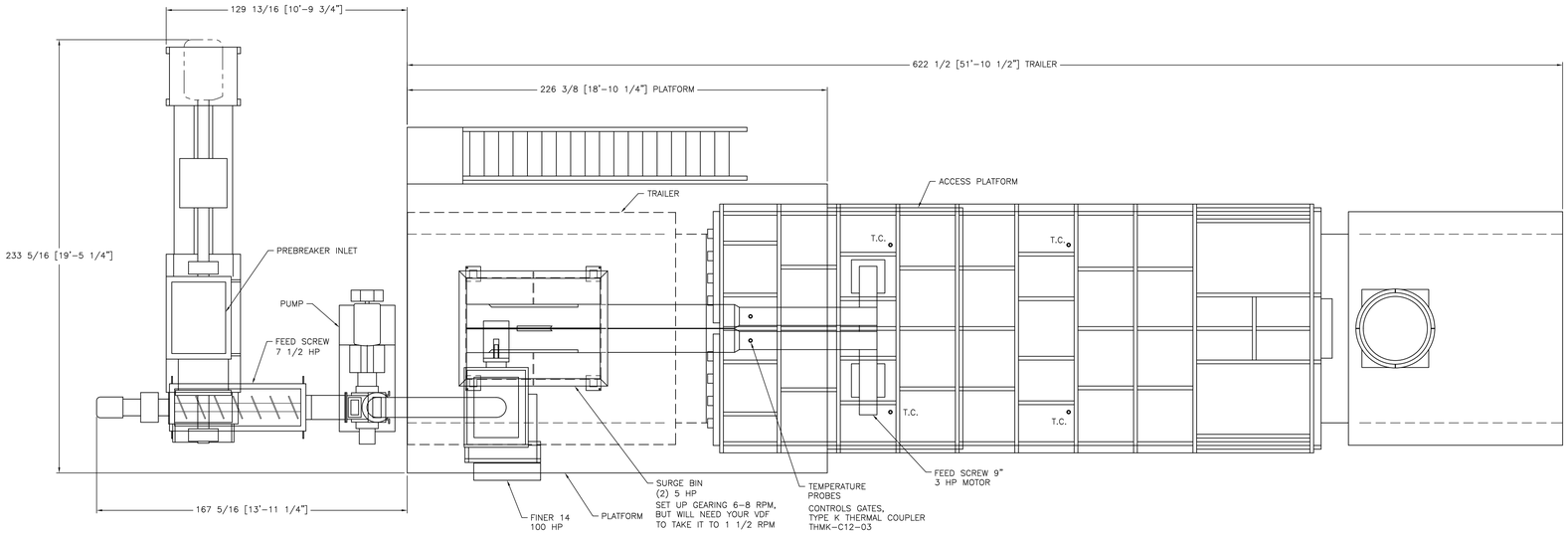
Process and Instrumentation Diagram 283-D

PROJECT MANAGER	DEPARTMENT MANAGER
LEAD DESIGN PROF.	CHECKED BY
TASK/PHASE NUMBER	DRAWN BY A. LYNCH
PROJECT NUMBER	DRAWING NUMBER 2-9

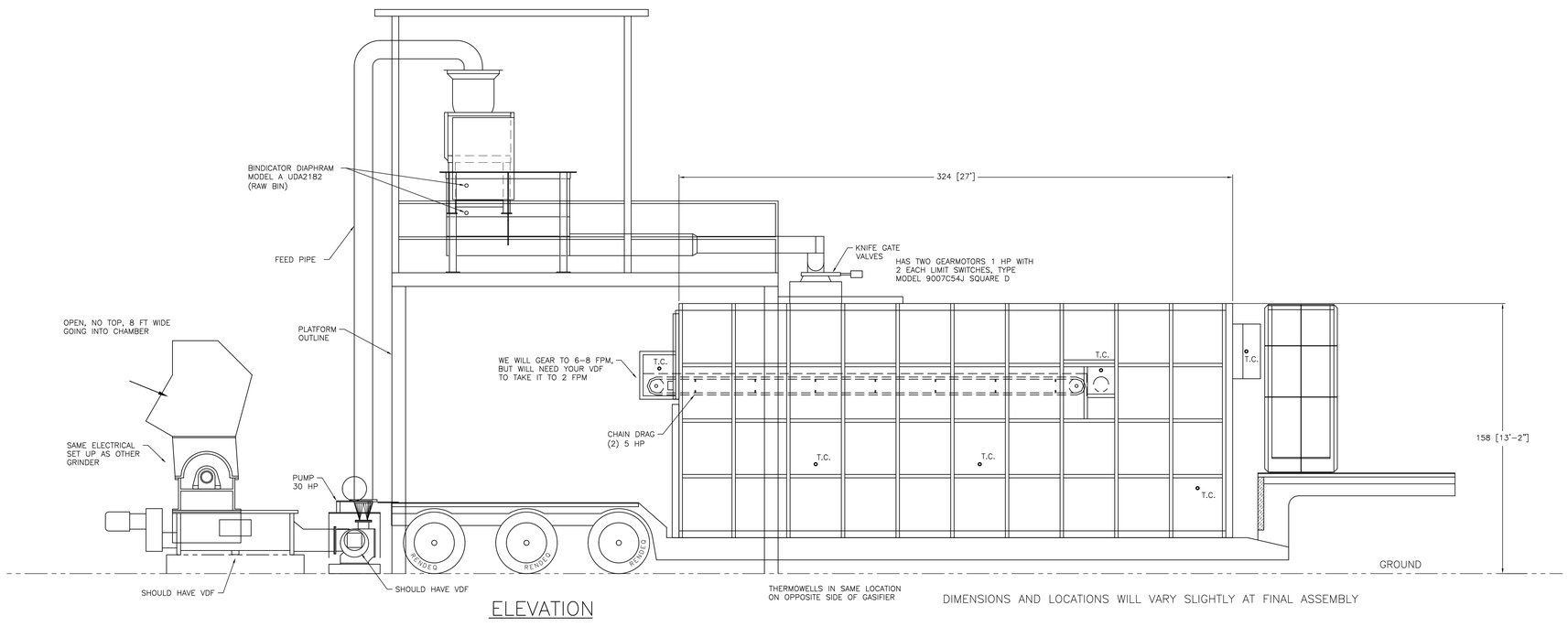
Acad Version : R18.1s (LMS Tech)
User Name : alynch
Date\Time : Tue, 31 Jan 2012 - 9:33am
Path\Name : C:\Users\alynch\Desktop\CAD DETAILS\2-9 - Process and Instrumentation Diagram 283-D.dwg
Current Plotstyle : ByLayer
Layout Tab: 2-9

APPENDIX E: RENDEQ Design Drawings


320
65
30
66
24
22
126
34
80
SCREW OUT



PLAN VIEW



ELEVATION

DIMENSIONS AND LOCATIONS WILL VARY SLIGHTLY AT FINAL ASSEMBLY

NO	DATE	REVISION	APPR
1	2/14	ADDED ELECTRICAL NOTES	

TOLERANCES (EXCEPT AS NOTED)
DECIMALS
FRACTIONS
ANGLES
REF:

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

PROJECT:

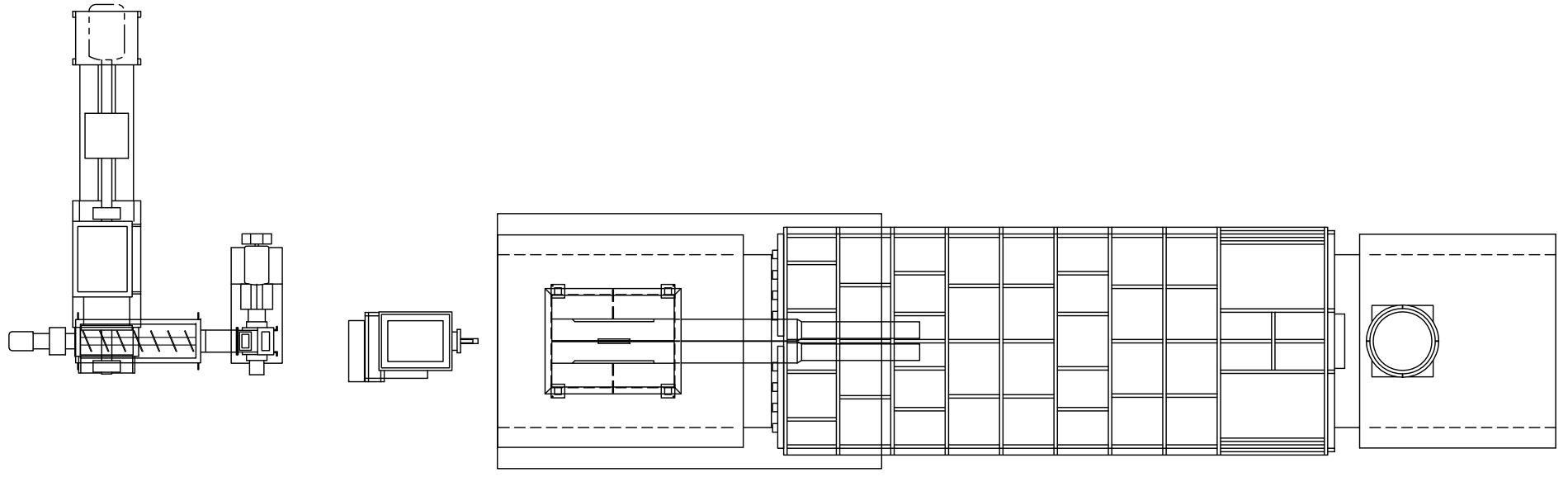
PB24 RAW GRINDER
THERMOWELL LOCATIONS

CUSTOMER: ARCADIS

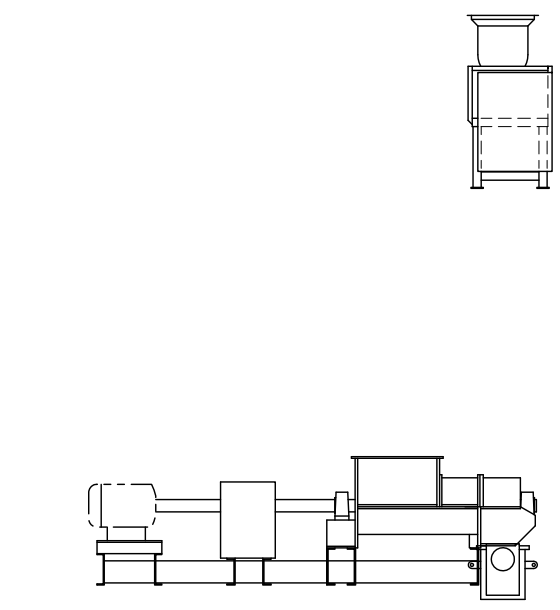
LOCATION:

SCALE NONE	DATE
DRAWN	SHEET 1 OF 1

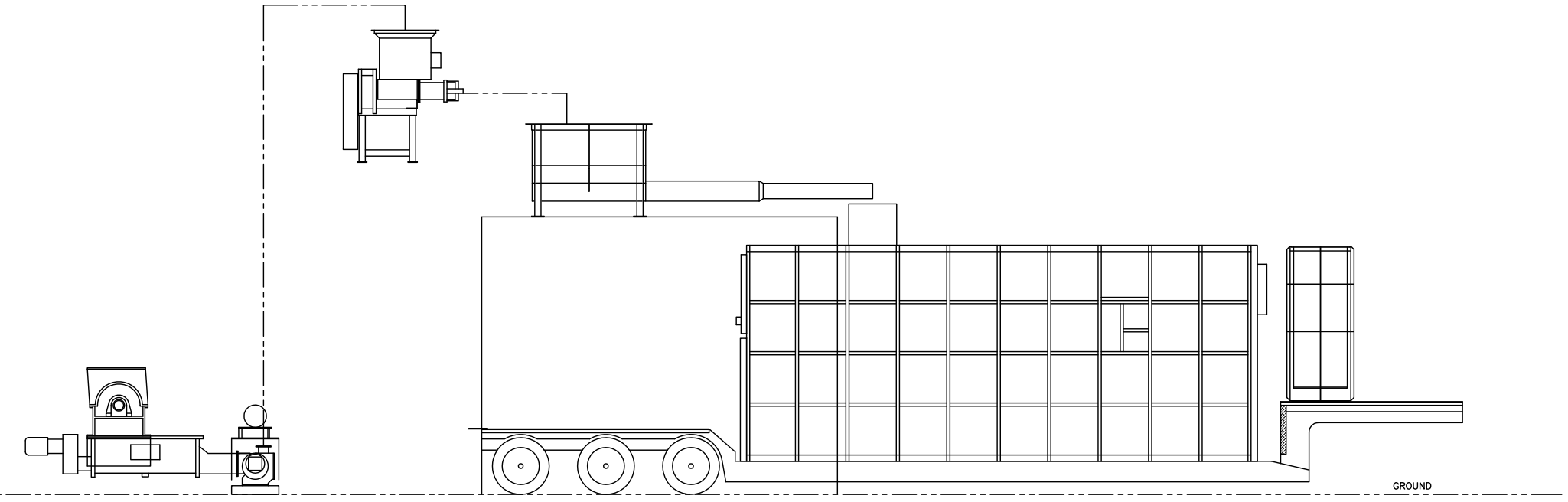
PROJECT NO.	DRAWING NO.	REV.
13-409	CUST	0



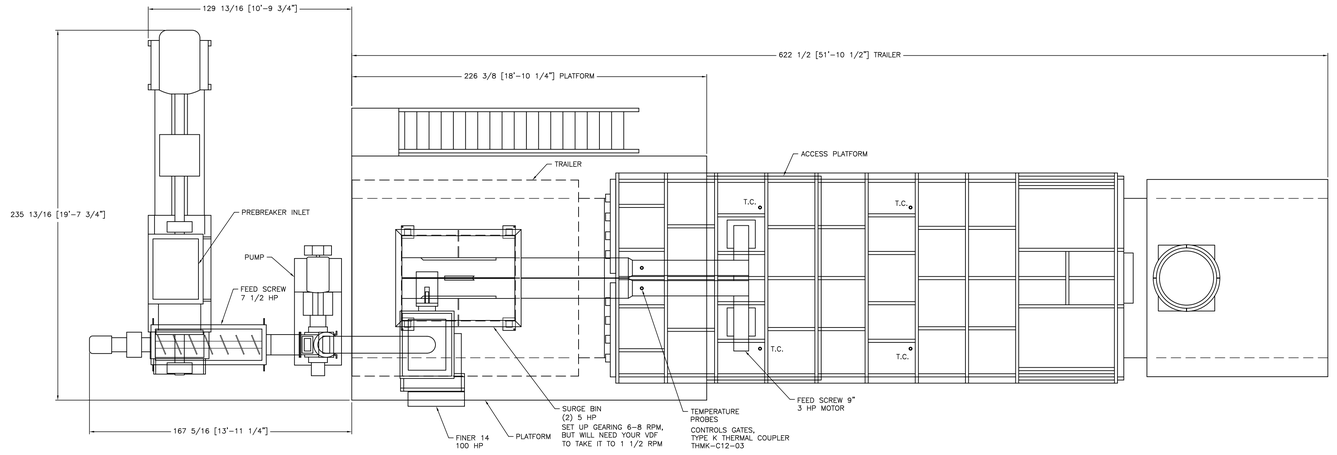
PLAN VIEW



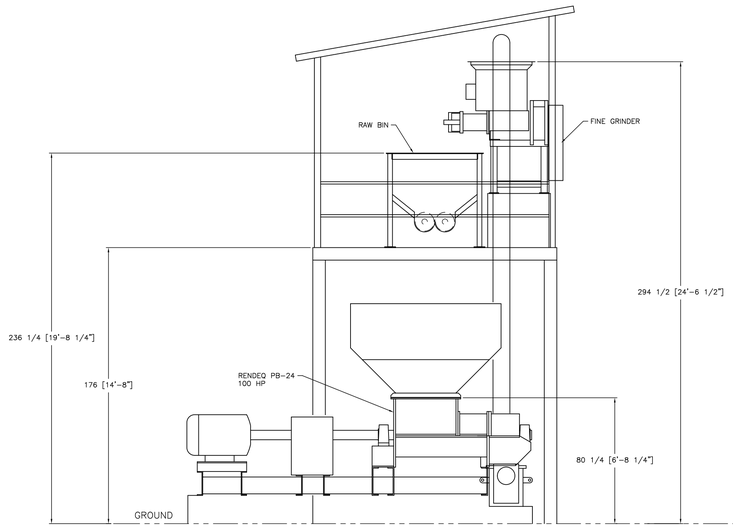
PARTIAL
END VIEW



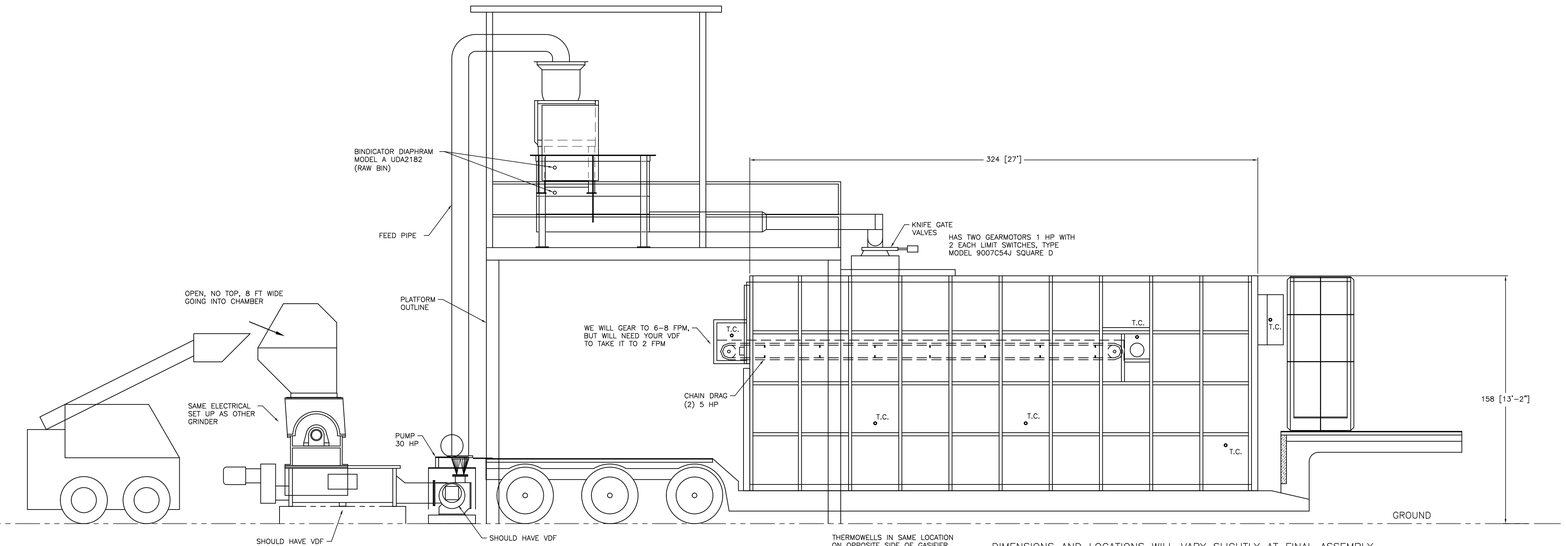
ELEVATION



PLAN VIEW



PARTIAL
END VIEW



ELEVATION

DIMENSIONS AND LOCATIONS WILL VARY SLIGHTLY AT FINAL ASSEMBLY

NO	DATE	REVISION	APPR
1	2/14	ADDED ELECTRICAL NOTES	

TOLERANCES (EXCEPT AS NOTED)
DECIMALS
FRACTIONS
ANGLES
REF:

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

PROJECT:

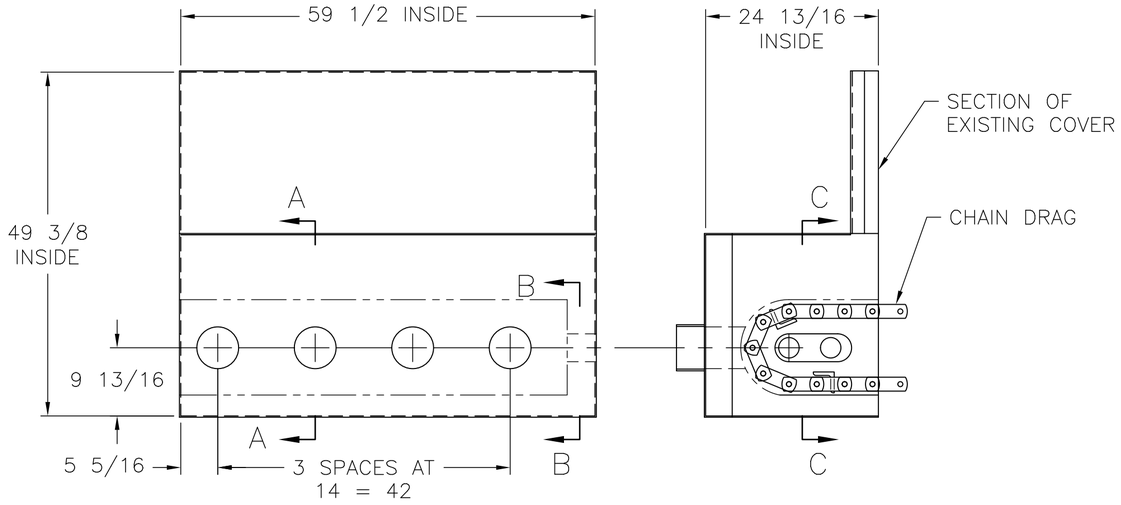
PB24 RAW GRINDER

CUSTOMER: ARCADIS

LOCATION:

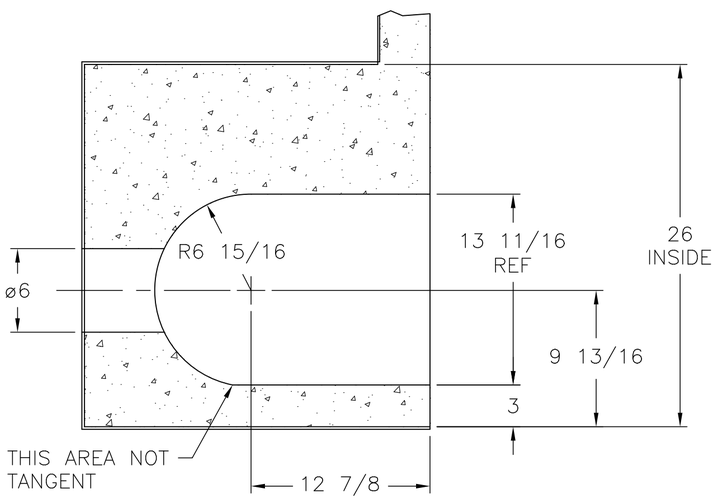
SCALE NONE	DATE
DRAWN	SHEET 1 OF 1

PROJECT NO.	DRAWING NO.	REV.
13-409	CUST	1

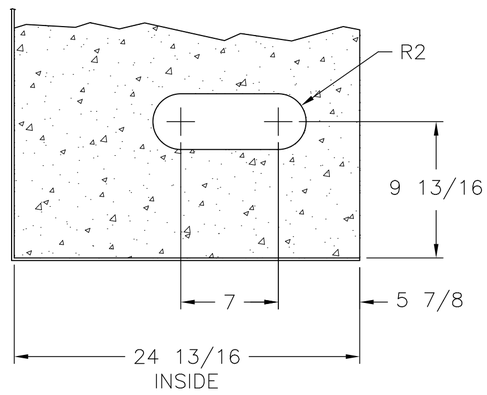


END COVERS

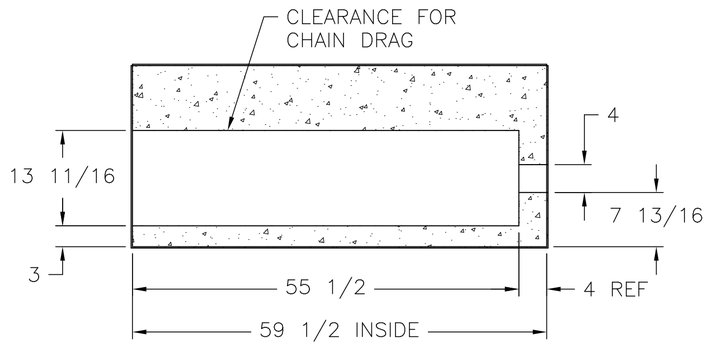
FABRICATE ONE AS SHOWN;
ONE OPPOSITE



SECTION A–A



SECTION B–B



SECTION C–C

NO	DATE	REVISION	APPR

TOLERANCES (EXCEPT AS NOTED)
DECIMALS
FRACTIONS
ANGLES

REF:

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

PROJECT:

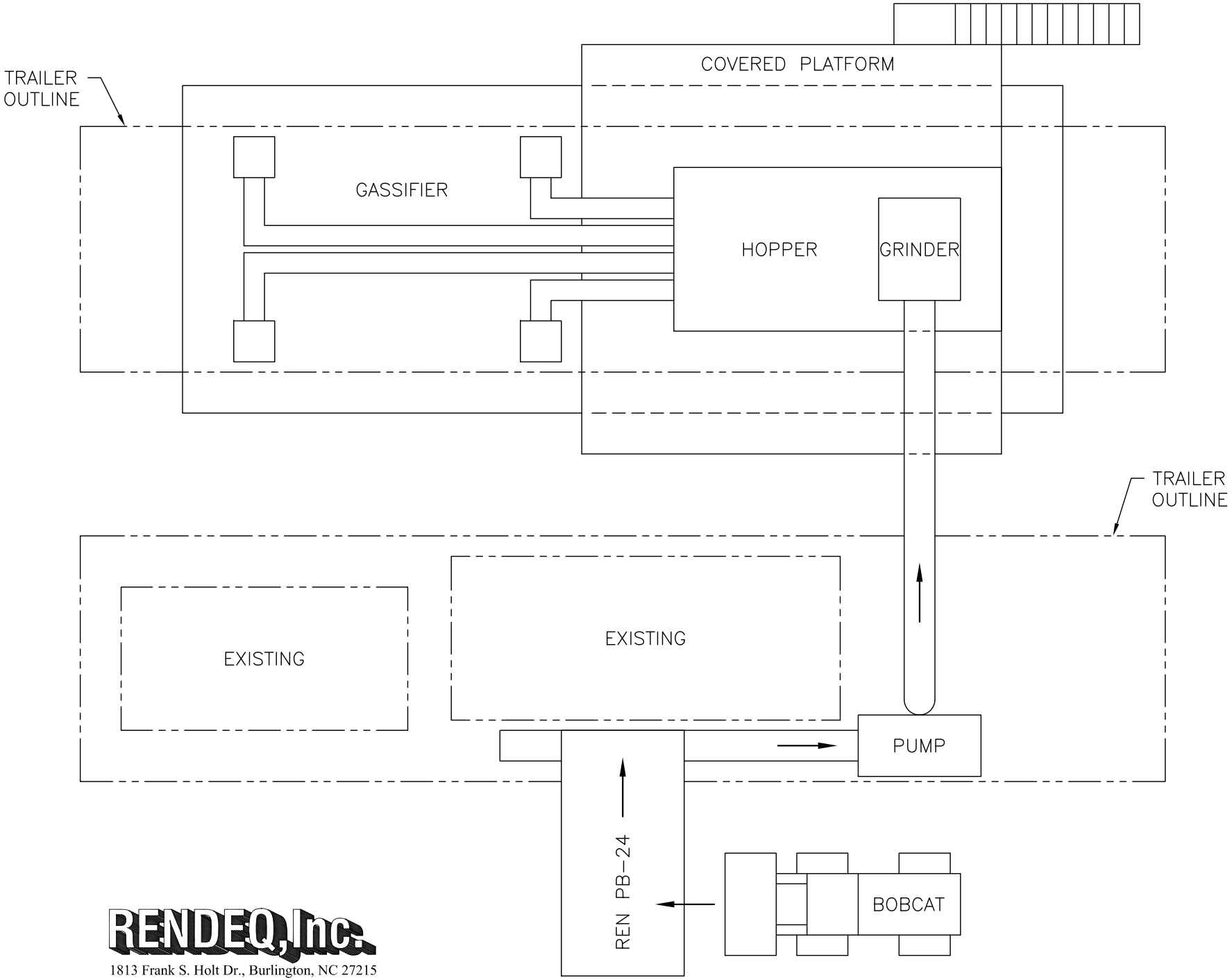
PROPOSED REFRACTORY
GASIFIER END DOORS

CUSTOMER:

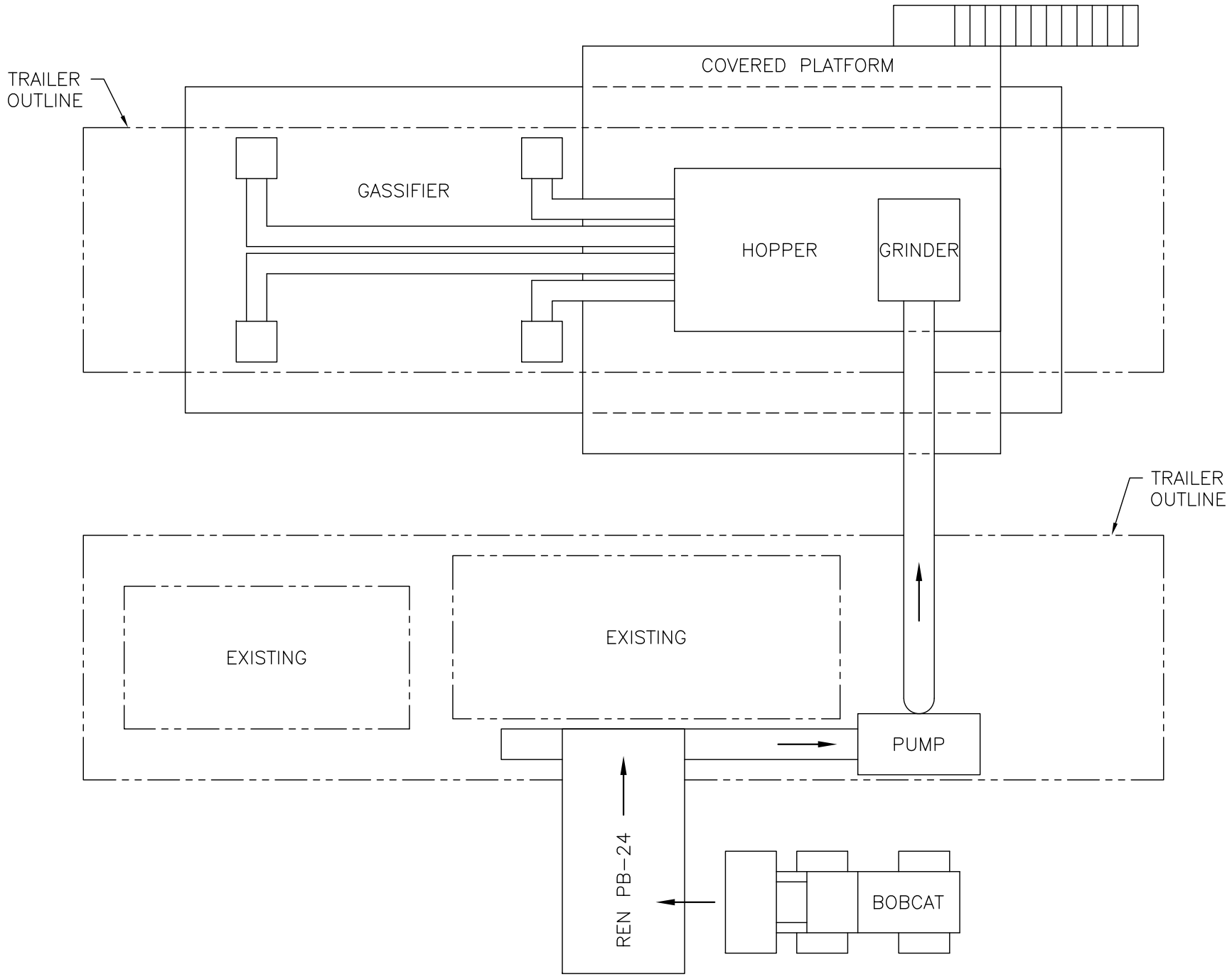
LOCATION:

SCALE –	DATE
DRAWN	SHEET 1 OF 1
PROJECT NO. 13–409	DRAWING NO.

REV. 2



RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004



RENDEQ, Inc.
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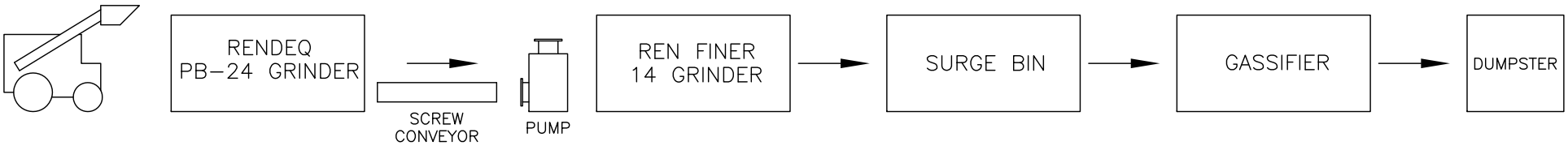
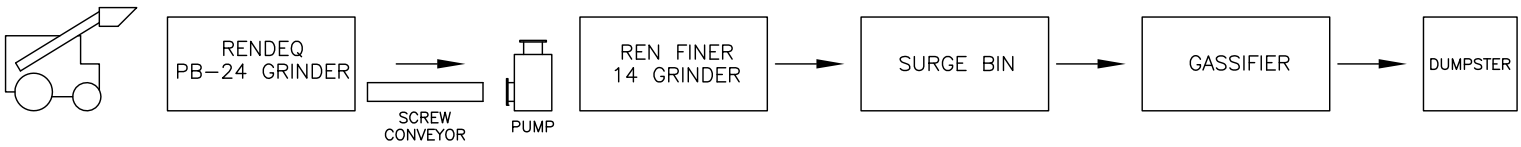
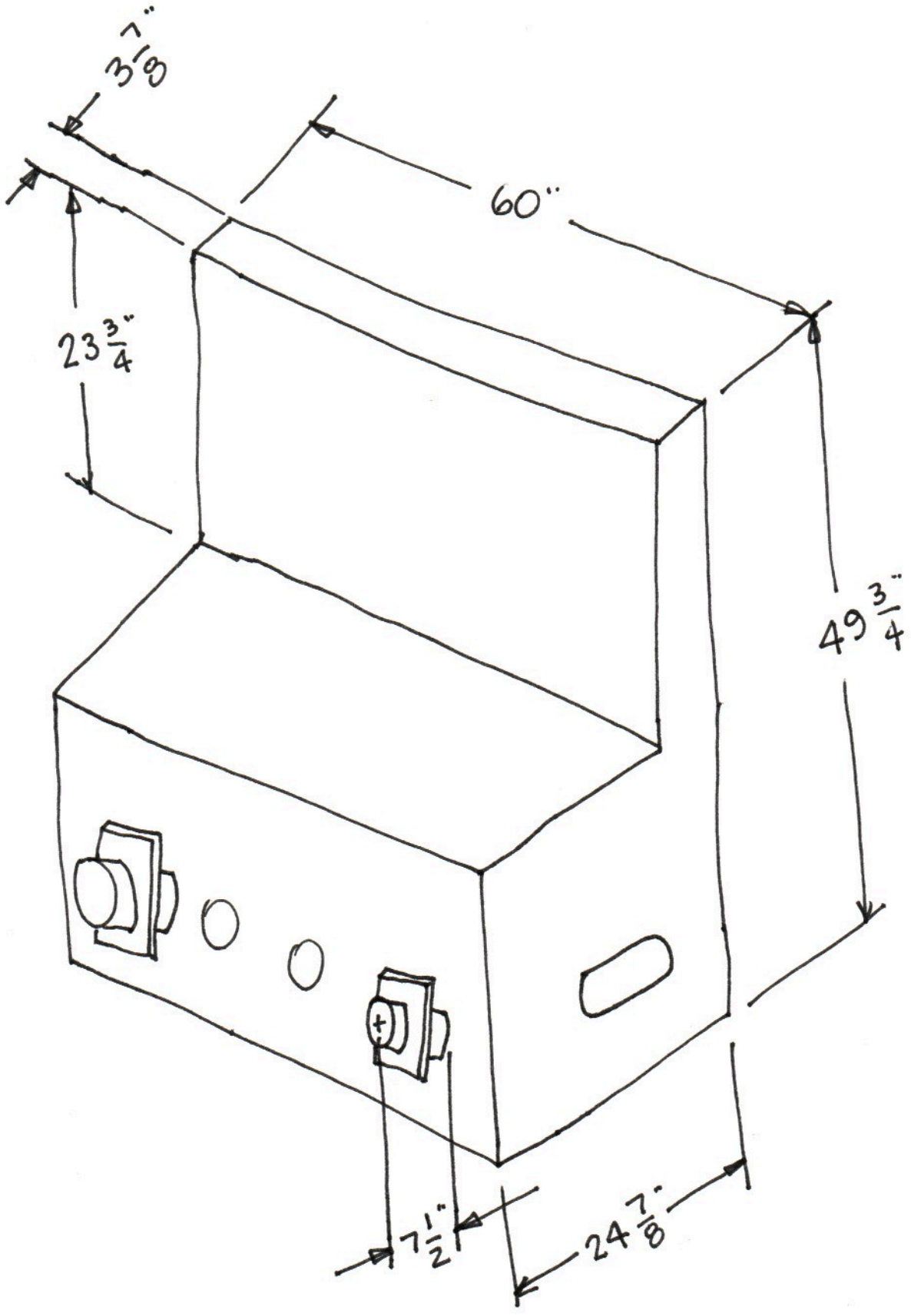
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

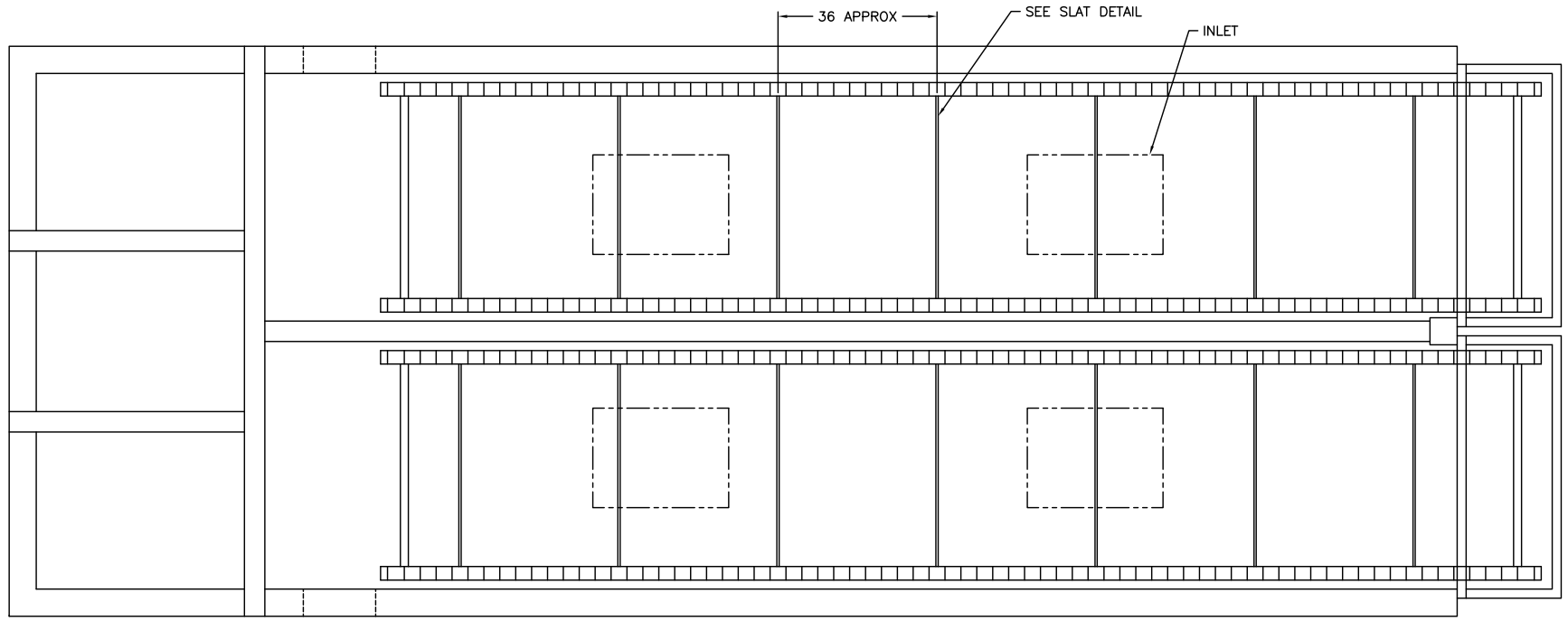
OPERATIONAL FLOW



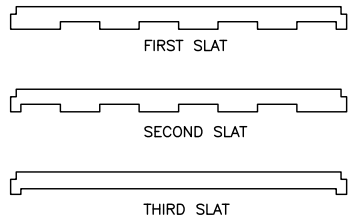
OPERATIONAL FLOW



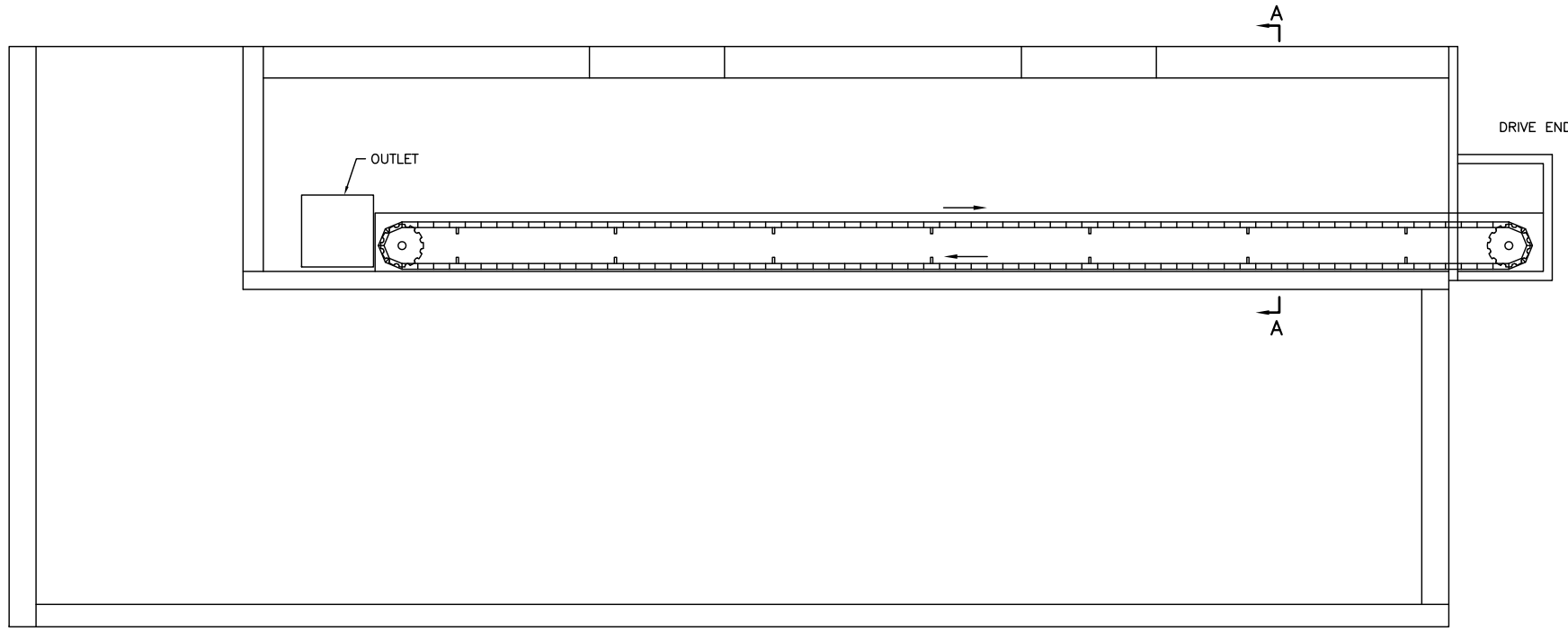

3 7/8"
60"
23 3/4"
49 3/4"
7 1/2"
24 7/8"



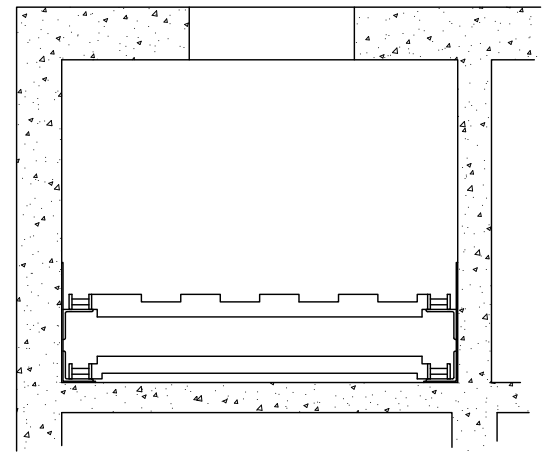
PLAN VIEW



SLAT DETAIL



SIDE ELEVATION



VIEW A–A

NO	DATE	REVISION	APPR

TOLERANCES (EXCEPT AS NOTED)
DECIMALS
FRACTIONS
ANGLES
REF:

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

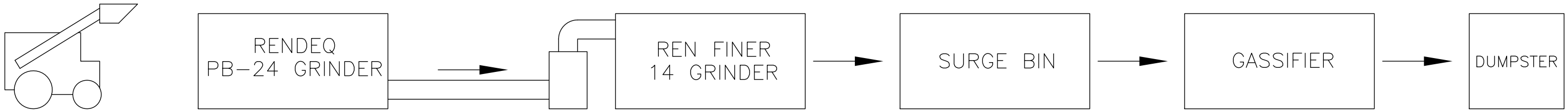
PROJECT:

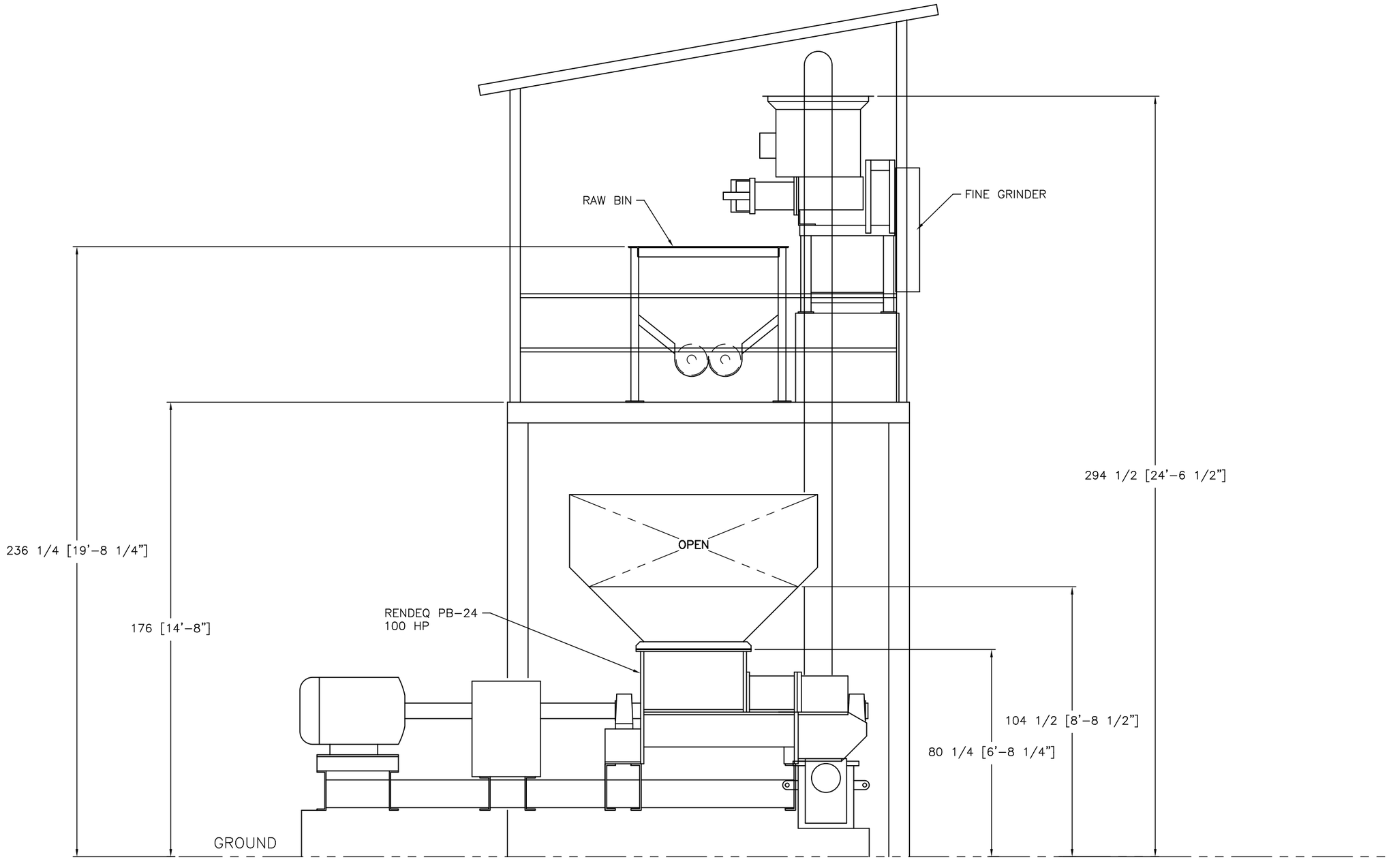
GASSIFER
DRAG CONCEPT

CUSTOMER: EPA

LOCATION:

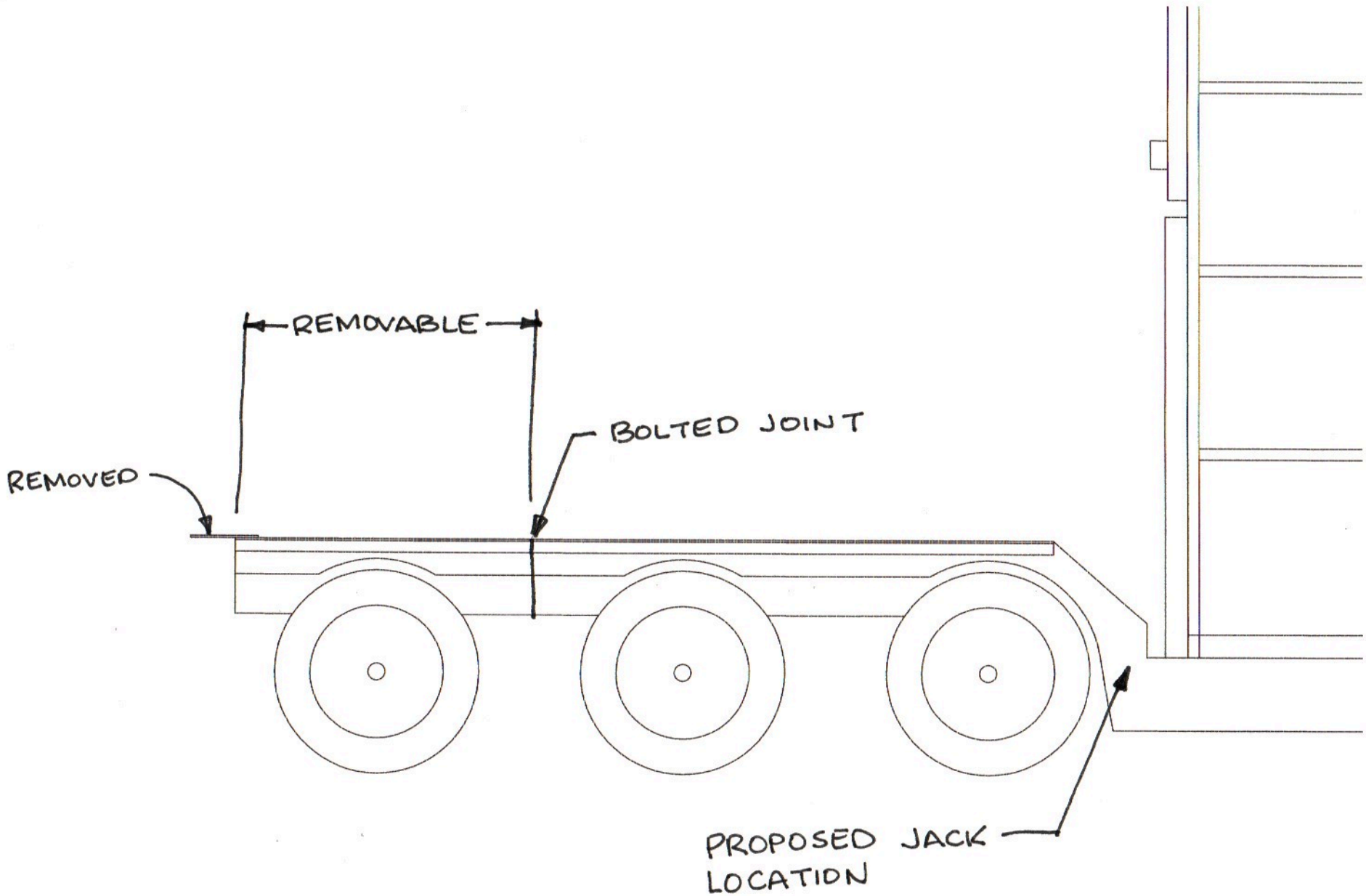
SCALE NONE	DATE 1/9/14	
DRAWN	SHEET 1 OF 1	
PROJECT NO.	DRAWING NO. 13409–C	REV. 0


RENDEQ
PB–24 GRINDER
REN FINER
14 GRINDER
SURGE BIN
GASSIFIER
DUMPSTER



PARTIAL

END VIEW


REMOVABLE
BOLTED JOINT
REMOVED
PROPOSED JACK
LOCATION

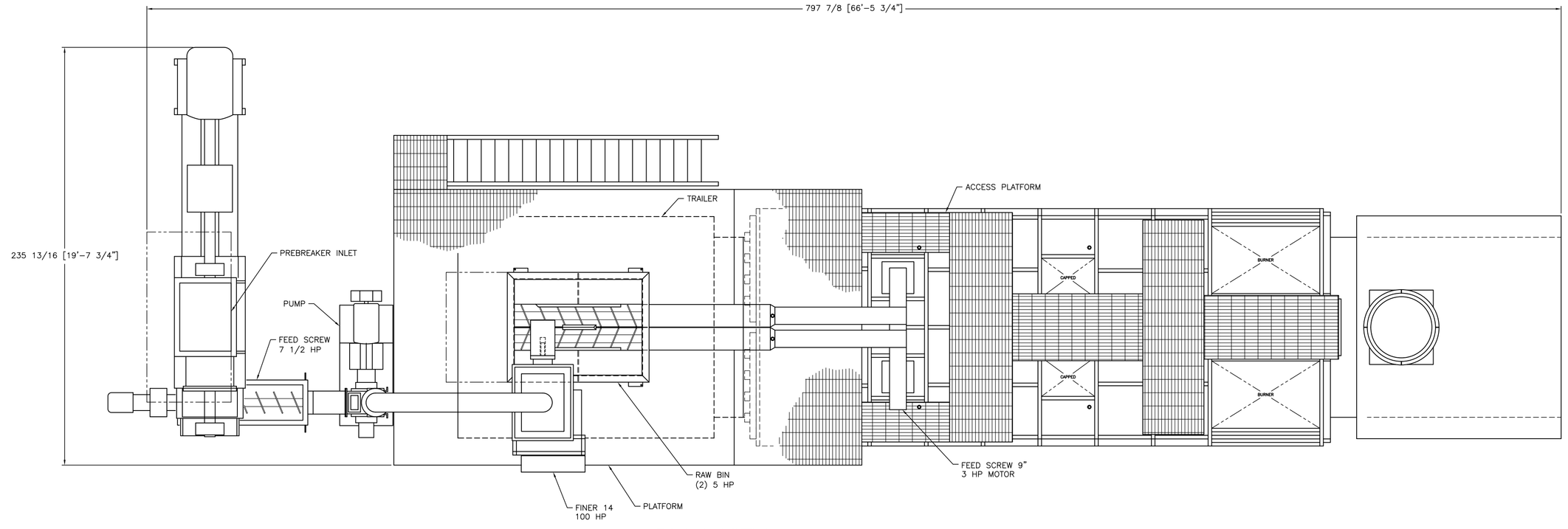
APPENDIX C: Gasifier Grinding, Transfer, Accumulation, and Feed (GTAF) System Manuals

RENDEQ

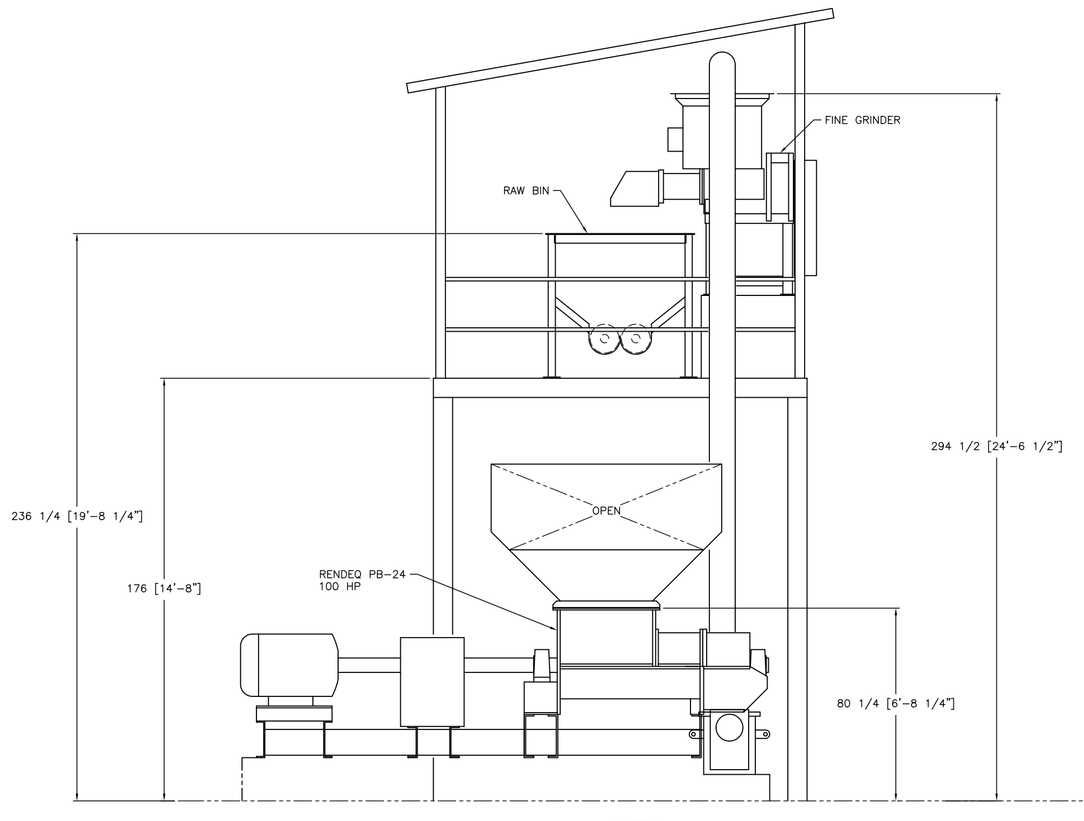
Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

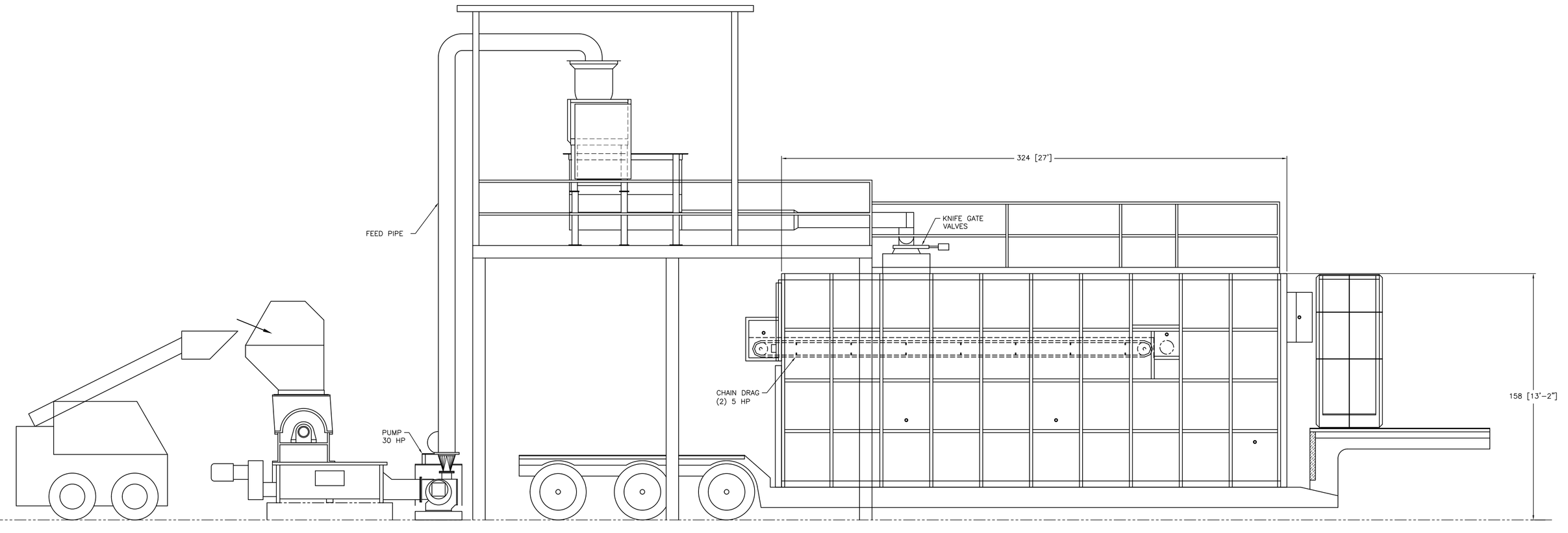
1813 Frank Holt Drive Burlington NC 27215 336-226-1100 rendeq.com



PLAN VIEW



PARTIAL
END VIEW



ELEVATION

DIMENSIONS AND LOCATIONS WILL VARY SLIGHTLY AT FINAL ASSEMBLY

RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC. GTAF System
Table of Contents

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RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 1
Pre-breaker

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RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC. GTAF System
PRE-BREAKER

Item	Qty	Part Numbers/ Description
Prebreaker	1	Reitz PB 24

INTRODUCTION

STANDARD DRIVES — This literature applies to all standard Series F gear drives (FZ, FXZ, FC, FCL & FCX) with ratings, speeds, ratios and dimensions as catalogued in current Falk bulletins. Refer to the Factory for all specials and modifications.

HOW TO ORDER Give complete data shown on reducer nameplate. Also, give Reference Numbers and name of parts required. — Drawings and Reference Numbers are representative of all sizes and the actual parts may not agree in exact detail for each unit. Complete nameplate data and parts Reference Numbers will assure receipt of correct parts.

The numerical designation stamped on the nameplate completely identifies all parts used in the reducer. All units with exactly the same nameplate markings have interchangeable rotating elements.

PINION-SHAFT-BEARING ASSEMBLIES — With today's production procedures Falk can normally furnish a total rotating assembly more economically than a customer can if he purchases individual parts, disassembles the old parts, and reassembles using some new and some old parts. Falk replacement assemblies also reduce down time and always consist of all new parts.

Pinion-shaft assemblies such as Reference Number 2 include the pinion, shaft, bearings, locknut and spacers, keys, dowels, Nilos rings, etc., as required. Gears, such as 2P4, 3P4, and 4P4 ARE NOT included and must be ordered separately if required. If gears 2P4, 3P4, or 4P4 are ordered without the shaft on which they are mounted, also order a new locknut. Bearings are mounted on the shafts, except when a gear (as 2P4) must precede the bearing during reducer assembly; bearings are then shipped loose in their original packages.

Note that some elements cannot be removed in the field because of the high interference fit between parts. The parts, in effect, become integral or non-removable and, in turn, make some bearings on high speed and intermediate shafts non-removable. See service manual for details. All low speed pinion and gear shaft bearings are removable and the assemblies may be purchased with or without the bearings.

SHIM-GASKETS — When shaft seals are ordered, shim-gasket(s) for the seal cage(s) are furnished with the seals. When replacing internal rotating elements, order Seals and Shim-Gasket Kit Ref. No. 100. The Kit consists of a complete set of shims and gaskets for the unit.

BACKSTOPS — When internal backstops are replaced, also replace the low speed pinion shaft. New shim-gaskets are furnished with the internal backstop package. Return external #20 and #60 backstops to the Factory for servicing; replace the high speed shaft if damaged during backstop removal. Refer to Service Manual 148-911 for replacing bearings in external backstops or price new replacement #20 and #60 external backstops from the gear drive price list.

FASTENERS — Fasteners and dowels are sold in sets for a specific item, i.e. (4) for an end cover, (8) for a L.S. flange, (16) for a housing cover, etc. *Fasteners* describes cap screws, bolts, studs and nuts, and lockwashers as required.

RATIO CHANGE — Refer complete information to the Factory.

MOTOR BRACKETS — Refer complete information to the Factory.

SHAFT COUPLINGS — Refer to coupling parts guide and price list.

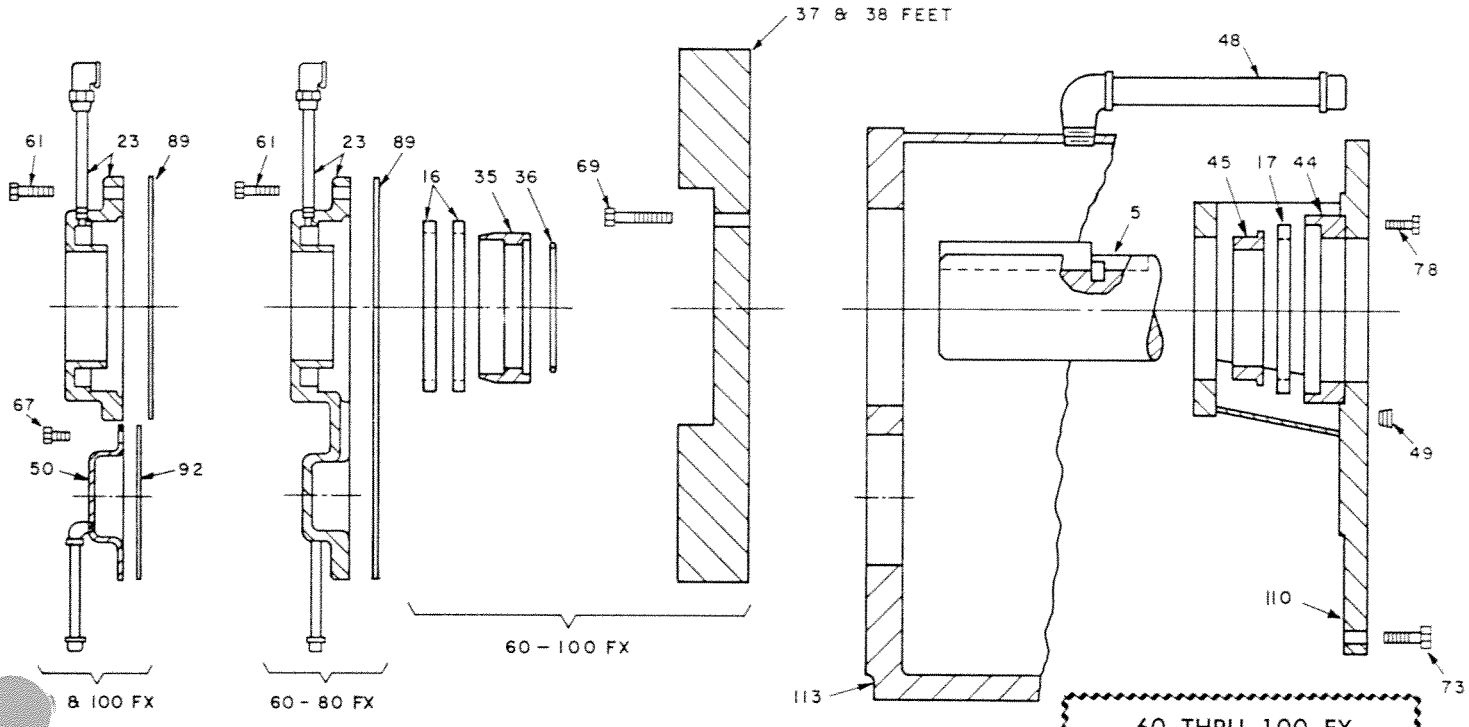
Ref. No.	Part Description
	ROTATING ELEMENTS
1 thru 5	Refer to Page 4
10	Fan, Cooling
11	Fan Guard
	OIL SEALS
14	Seal, All H.S.S.
15	Seal, L.S.S. — Horiz.
16	Seal (2), L.S.S. — Vert.
17	Seal, H.S.S. — Vert. Inner (for 80, 90 & 100FX2)
	CAGES, COVERS, & MISC.
20	Dipstick & Plug
21	Cage, Seal — H.S.
22	Cage, Seal — L.S.S. Horiz.
23	Cage, Seal — L.S.S. Vert.
27	Cover, Int. — 1st
28	Cover, Int. — 1st & 2nd
29	Cover, Pinion — L.S. Horiz.
32	Cover, Backstop — Internal
33	Cage, Backstop — Internal
34	Backstop — Internal, Incl. Ref. No. 91 (for 60-90F) Backstop — External, Sizes 20 & 60 (for 100-130F)
35	Sleeve, L.S.S. — Seal
36	"O" Ring (for Ref. No. 35)

Ref. No.	Part Description
37	Foot, R.H. — Near Side } Identical for
38	Foot, L.H. — Far Side } Sizes 60-100
39	Pan, Oil
41	Spacer, Bearing — L.S. Pinion (for 90F & 60-90FX)
42	Spacer, Bearing — 1st Int. (for 60-90F4)
44	Cage, Seal — H.S. Inner (for 80-100FX2)
45	Cage, Bearing — H.S. (for F2 & FX2)
46	Deflector, Oil — F2
47	Spacer, Bearing — Int. (for 60-90F3 & F4)
48	Standpipe, Oil — Vert.
49	Vent, Air — Vert.
50	Cover, Pinion — L.S. Vert. (for 90 & 100FX)
53	Plate, Thrust (for 100-130F)
	FASTENER & DOWEL SETS
59	For Ref. No. 21
60	For Ref. No. 22
61	For Ref. No. 23
64	For Ref. No. 27
65	For Ref. No. 28
66	For Ref. No. 29
67	For Ref. No. 50
68	For Ref. No. 32 & 33

Ref. No.	Part Description
69	For Ref. No. 37 & 38
70	For Ref. No. 39
73	For Ref. No. 110
74	For Ref. No. 112
78	For Ref. No. 44
79	For Ref. No. 46
80	For Ref. No. 53
	SHIM-GASKETS (See Ref. No. 100)
87	For Ref. No. 21
88	For Ref. No. 22
89	For Ref. No. 23
91	For Ref. No. 29, 32 & 33
92	For Ref. No. 50 (for 90 & 100FX)
94	For Ref. No. 113
97	For Ref. No. 27
98	For Ref. No. 28
100	**SHIM-GASKET KITS** 60-130F Includes Ref. Nos. 87, 88, 91, 94, 97, 98 60-100FX Includes Ref. Nos. 87, 89, 92, 94, 97, 98
	HOUSING COMPONENTS (Furnished only as assemblies.)
110	Head, H.S.
112	Plate, Bearing — L.S.
113	Housing, Helical

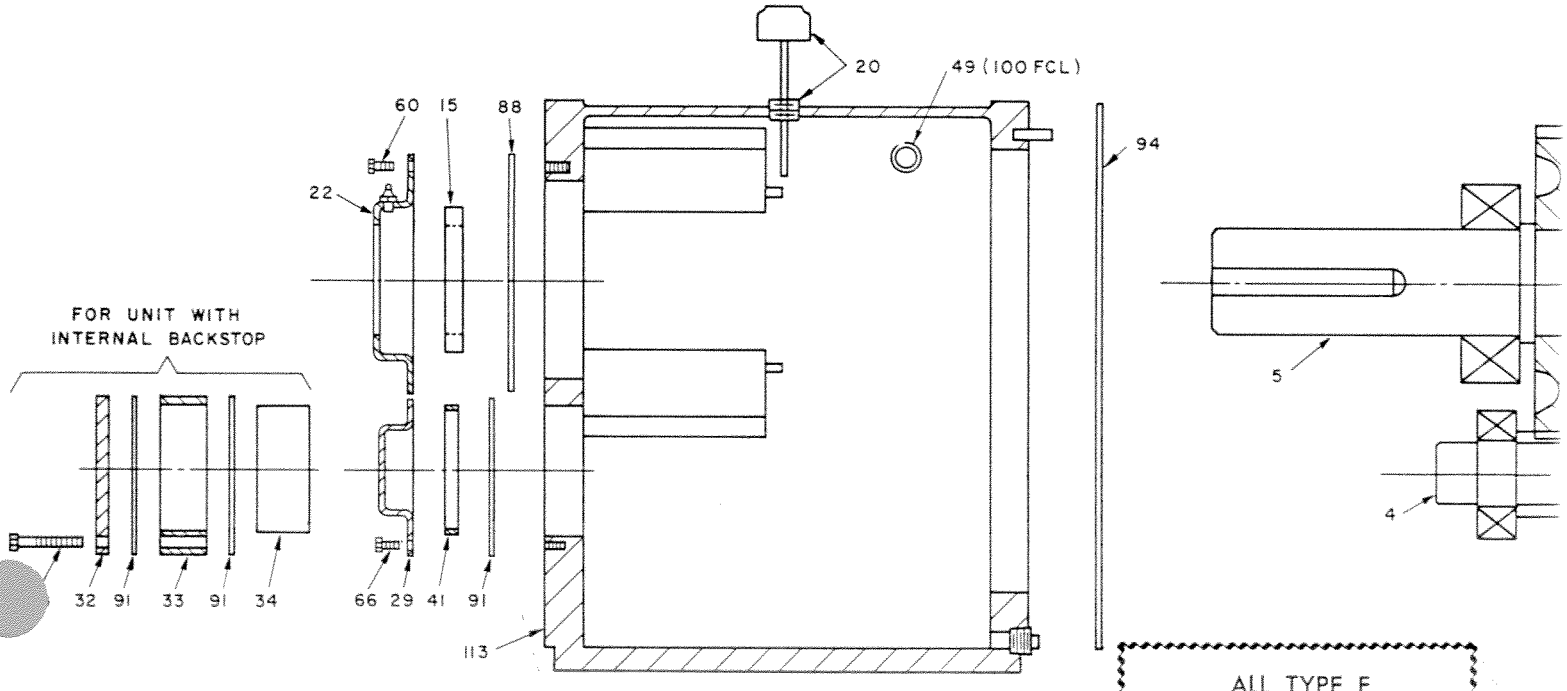
REFER TO PAGE 1 FOR INSTRUCTIONS

PARTS DESCRIPTIONS { 1 THRU 5, PAGE 4 / OVER 10, PAGE 1

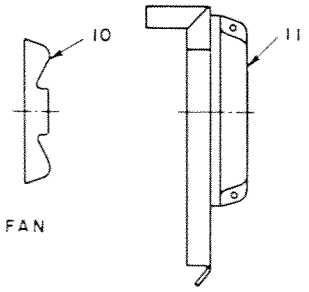


ALL TYPE FX L.S. ENDS

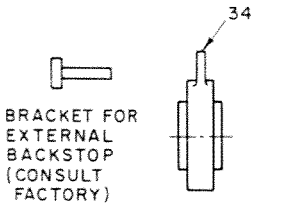
60 THRU 100 FX
H.S. END



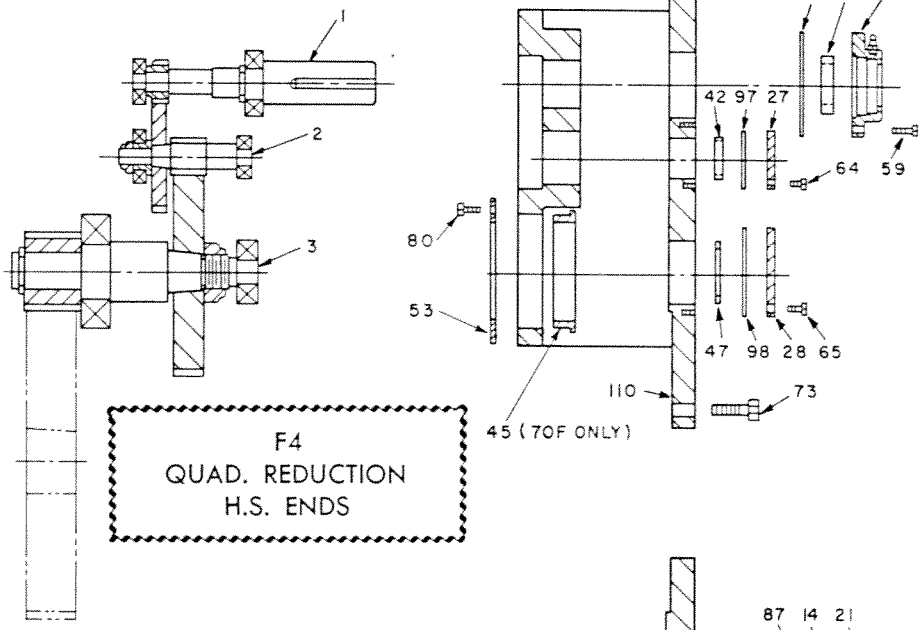
ALL TYPE F
L.S. ENDS



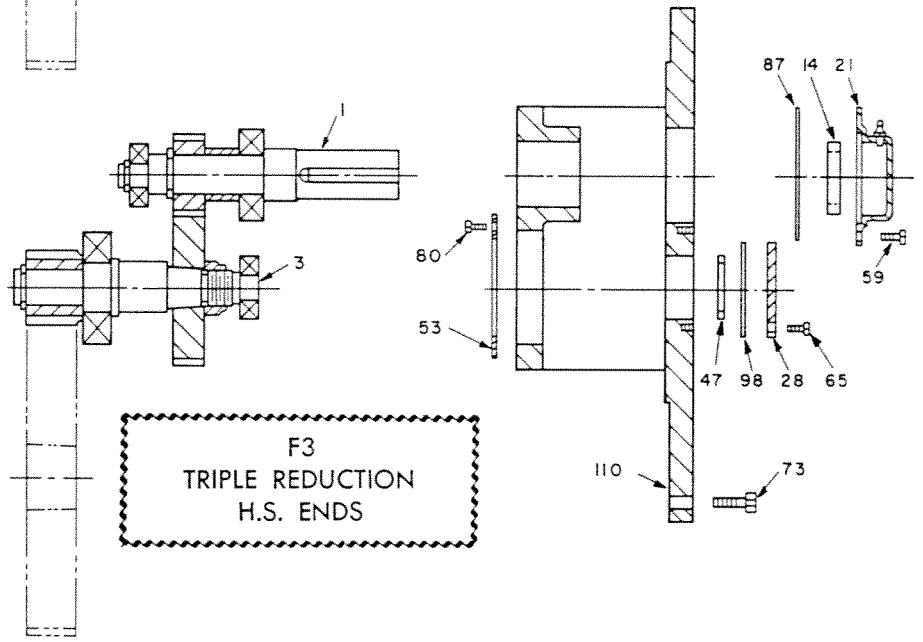
SIZES 60-130 F



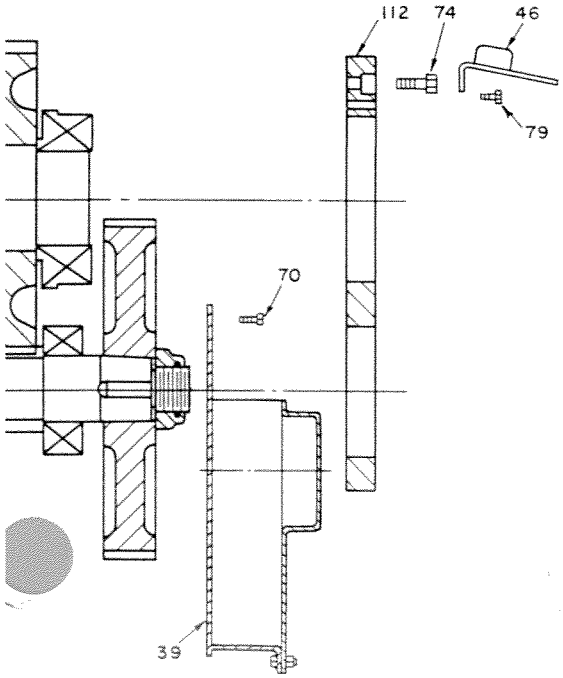
SIZES 100-130 F

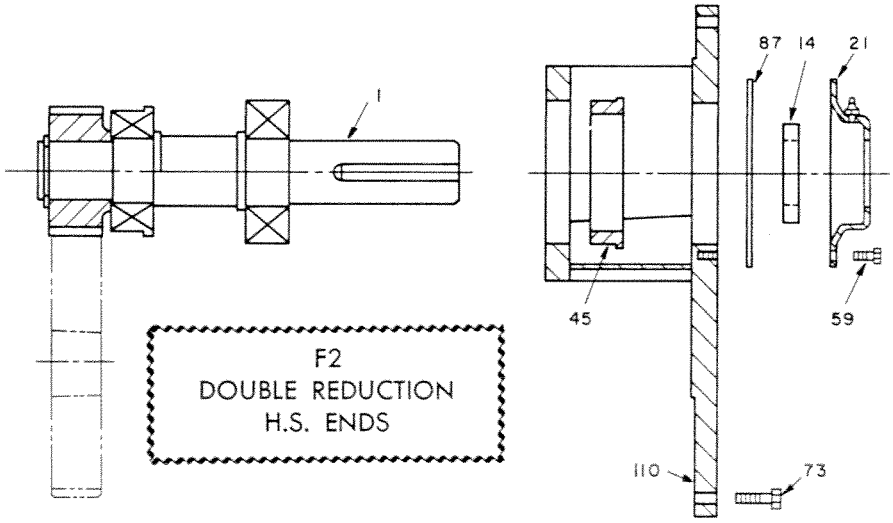


F4
QUAD. REDUCTION
H.S. ENDS

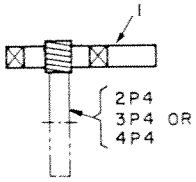
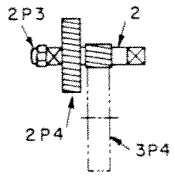
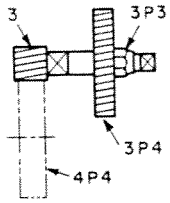
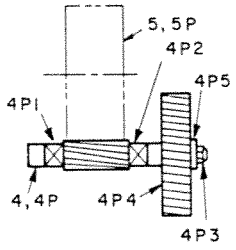
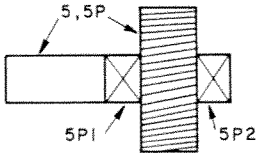


F3
TRIPLE REDUCTION
H.S. ENDS





F2
DOUBLE REDUCTION
H.S. ENDS

Typical Assembly	Ref. No.	Part Description { See notes below for WB and WOB
	1	H.S. Pinion & Shaft — WB
	2 2P3 2P4	Int. Pinion & Shaft — WB (1st Int. for F4, Quad. Red.) Locknut — For 2P4 Gear, H.S. — Mates with Ref. No. 1 for F4, Quad. Red.
	3 3P3 3P4	Int. Pinion & Shaft — WB (1st Int. for F3, Triple Red.) (2nd Int. for F4, Quad. Red.) Locknut — For 3P4 Gear — Mates with Ref. No. 1 for F3, Triple Red. Ref. No. 2 for F4, Quad. Red.
	4 4P 4P1 4P2 4P3 4P4 4P5	WB WOB } L.S. Pinion & Shaft Bearing — Outer Bearing — Inner Locknut — For 4P4 Gear, H.S. — Mates with Ref. No. 1 for F2, Double Red. Ref. No. 3 for F3, Triple Red. and F4, Quad. Red. Spacer — For 100FX & 100-130F Only
	5 5P 5P1 5P2	WB WOB } L.S. Helical Gear & Shaft Bearing — Outer Bearing — Inner

WB = With bearings (and locknut if required), but without gears 2P4, 3P4 or 4P4.

WOB = Without bearings, without gears 2P4, 3P4 or 4P4, (but with locknut if required).

Refer to Page 1 for complete instructions

FALK PART NUMBERS

UNIT SIZE	Number of Reductions		H.S. Shaft Falk Seal Part No. All Type F Units	L.S. Shaft — Falk Seal Part Number			
	Concentric Shaft Units	Right Angle Shaft Units		Types FC and FZ	Types FCX and FZX	Types FCB and FZB	
						Extension	Inner
20	2	3	912743	912853	912775	912748	912676
	3	4	912743	912853	912775	912748	912676
30	2	3	912743	912749	912859	912753	912860
	3	4	912746	912749	912859	912753	912860
	4	5	912743	912749	912859	912753	912860
40	2	3	912746	912775	912756	912754	912861
	3	4	912746	912775	912756	912754	912861
	4	5	912743	912775	912756	912754	912861
50	2	3	912749	912781	912790	912757	912546
	3	4	912749	912781	912790	912757	912546
	4	5	912743	912781	912790	912757	912546
60	2	3	912845	912757	912741	912758	912857
	3	4	912849	912757	912741	912758	912857
	4	5	912746	912757	912741	912758	912857
70	2	3	912680	912759	912760	912741	912832
	3	4	912749	912759	912760	912741	912832
	4	5	912746	912759	912760	912741	912832
80	2	3	912680	912741	912791	912760	912816
	3	4	912845	912741	912791	912760	912816
	4	5	912849	912741	912791	912760	912816
90	2	3	912680	912850	912762	912761	912834
	3	4	912845	912850	912762	912761	912834
	4	5	912849	912850	912762	912761	912834
100	2	3	912757	912761	912763	912762	912856
	3	4	912775	912761	912763	912762	912856
	4	5	912775	912761	912763	912762	912856
110	2	...	912758	912787	...	...	...
	3	...	912775	912787	...	...	...
	4	...	912775	912787	...	...	...
120	2	...	912759	912762	...	...	...
	3	...	912778	912762	...	...	...
	4	...	912753	912762	...	...	...
130	2	...	912741	912763	...	...	...
	3	...	912778	912763	...	...	...
	4	...	912753	912763	...	...	...

SEAL PART NUMBERS AND DIMENSIONS

Falk Part Number	Manufacturers' Part No.★		Basic Dimensions—Inches		
	Chicago Rawhide	National	Shaft Dia	Outside Dia	Width‡
912546	CRWH 47394	455138	4.750	5.756	.562
912676	CRWH 27368	457316	2.750	3.756	.500
912680	CRWA 25075	476273	2.500	3.628	.375
912741	CRWA 34887	477437	3.500	4.505	.375
912743	CRWA 11124	471652	1.125	1.628	.250
912746	CRWA 13650	471192	1.375	2.129	.312
912748	CRWA 16118	....	1.625	2.441	.312
912749	CRWA 17285	471504	1.750	2.441	.312
912753	CRWA 19993	472397	2.000	3.005	.312
912754	CRWA 22441	472636	2.250	3.256	.375
912756	CRWA 26124	....	2.625	3.355	.375
912757	....	417316	2.750	3.756	.375
912758	CRWA 29907	475995	3.000	4.008	.375
912759	CRWA 32395	476470	3.250	4.254	.375
912760	CRWA 39923	....	4.000	5.004	.375
912761	CRWA 44960	....	4.500	5.506	.375
912762	CRWA 49985	476865	5.000	6.256	.500
912763	CRWA 54960	....	5.500	6.756	.500

Falk Part Number	Manufacturers' Part No.★		Basic Dimensions—Inches		
	Chicago Rawhide	National	Shaft Dia	Outside Dia	Width‡
912775	....	470898	2.125	2.879	.375
912778	CRWA 22354	471272	2.250	3.005	.375
912781	CRWA 26238	475458	2.625	3.628	.375
912787	CRWHA 47395	415138	4.750	5.756	.500
912790	CRWA 31139	476404	3.125	4.008	.375
912791	CRWA 42419	....	4.250	5.256	.375
912816	CRWH 70016	455517	7.000	8.009	.750
912832	CRWH 64994	455294	6.500	7.508	.562
912834	CRWH 78738	455121	7.875	9.383	.750
912845	CRWA 19832	472492	2.000	2.754	.312
912849	CRWA 16062	473230	1.625	2.256	.375
912850	CRWA 40077	....	4.000	5.631	.375
912853	CRWA 14939	470625	1.500	2.254	.312
912856	HDSI 590408	....	8.750	10.008	.625
912857	CRWH 52488	455645	5.250	6.507	.625
912859	....	470565	2.375	3.130	.375
912860	....	455389	3.625	4.504	.468
912861	CRWH 42426	455195	4.250	5.256	.468

★ Subject to substitution of equivalent seals without notice.
‡ The seal width listed may be slightly narrower than shown.

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Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 2
Secondary Grinder

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RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC. GTAF System
SECONDARY GRINDER

Item	Qty	Part Numbers/ Description
Secondary Grinder	1	Weiller 1109 Grinder

Service Instructions and Parts List for:

Gearbox Models
1398-5, 1398-5HA, 1398-5HE
1992-5HA, 1992-5HE

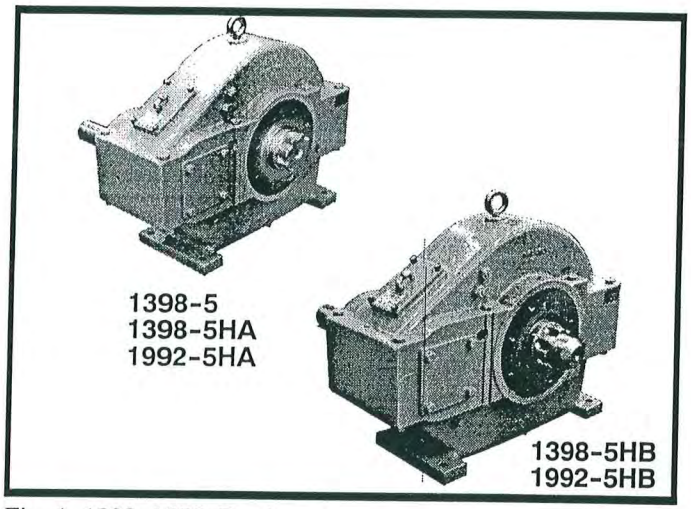

Fig. 1 1398, 1992 Gearboxes.

MODEL DIFFERENCES

The main difference between the models -5, -5HA and -5HB is the main shaft. Refer to parts list on page 5 for specific differences. Service instructions are identical for all models.

WARNING

Shut off and lock out power to the machine before performing service. All safety guards must be installed when operating.

GENERAL

Gear ratios are as follows:

1398-5	7.53:1
1398-5HA	7.53:1
1398-5HB	7.53:1
1992-5HA	4.84:1
1992-5HB	4.84:1

SPECIAL INSTRUCTIONS

After a "run-in" period of 40 hours, drain the oil from gearbox. Refill with five quarts of fresh AGMA-4EP Gear Oil or equivalent. Run reducer without load for 15 minutes. Drain and refill. Clean magnetic drain plug each time the plug is removed.

INSPECTION

Periodically remove the oil plug and check level and condition of oil. If no oil flows from plug hole, this indicates a need to add oil. Dirty or murky oil would indicate a worn main shaft seal. If excessive oil changes are required to keep oil clean, the main se should be replaced.

AT THIS POINT, POWER TO MACHINE SHOULD BE LOCKED OUT

Remove inspection cover to check condition of gea set and to refill box with oil. Check breather, locate on the cover, for blockage which could caus pressure build-up in the gearbox and may caus unnecessary leakage past oil seals.

LUBRICATION

Oil level should be maintained at upper oil plug.

Change oil every 6 months or if inspection indicate that it is contaminated. Add oil through th inspection cover opening.

Use oil specification AGMA-4EP Gear Oil o equivalent. A complete refill requires **five** quarts.

OUTER SEAL LUBRICATION

Lubricate this seal DAILY or at least every 8 hours o operation through the fitting on top of the gearbox flange. Refer to your specific Safety, Installation, Operation and Maintenance Manual for installation and removal.

MAIN SHAFT WEAR COLLAR REPLACEMENT

See **GEARBOX DISASSEMBLY.**

PINION SHAFT OIL SEAL REPLACEMENT

1. Remove belt guard cover, drive belts and pulleys from both gearbox pinion shaft and motor.
2. Remove belt guard body.
3. Remove seal carrier (5) from gearbox and remove seal (6) from carrier.
4. Clean all old sealant from the mating surfaces of carrier and from seal bore.
5. Apply a small amount of Permatex** (or equivalent) sealing compound to outer diameter of seal and to carrier mating surface.

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Food Processing Systems

6. Press seal into carrier with lip facing inward (toward the gearbox).
7. Place a strip of masking tape over key way of pinion shaft to protect seal lip from being cut.
8. Carefully install carrier and seal assembly. Secure carrier with four cap screws.
9. Replace gearbox pulley, all belts and belt guard at this time.

GEARBOX DISASSEMBLY

1. Remove pilot bearing cover (4) and pinion shaft end cap (7).
2. Remove seal carrier (5).
3. Remove eight cap screws (29) which attach top half of housing to bottom half.
4. Pry housing halves apart and lift off top housing.
5. Remove both tapered dowel pins (3) by tapping up from the bottom.
6. Remove lock nut and tabbed lock washer (10, 11).
7. Remove lock wire (16) and loosen two set screws (15) at least three turns.
8. Remove pinion shaft and bearing assembly.
9. Lift entire bull gear/main shaft/bearing assembly from lower housing.
10. Remove pilot bearing (12). A press or puller may be required.
11. Remove snap ring (13).

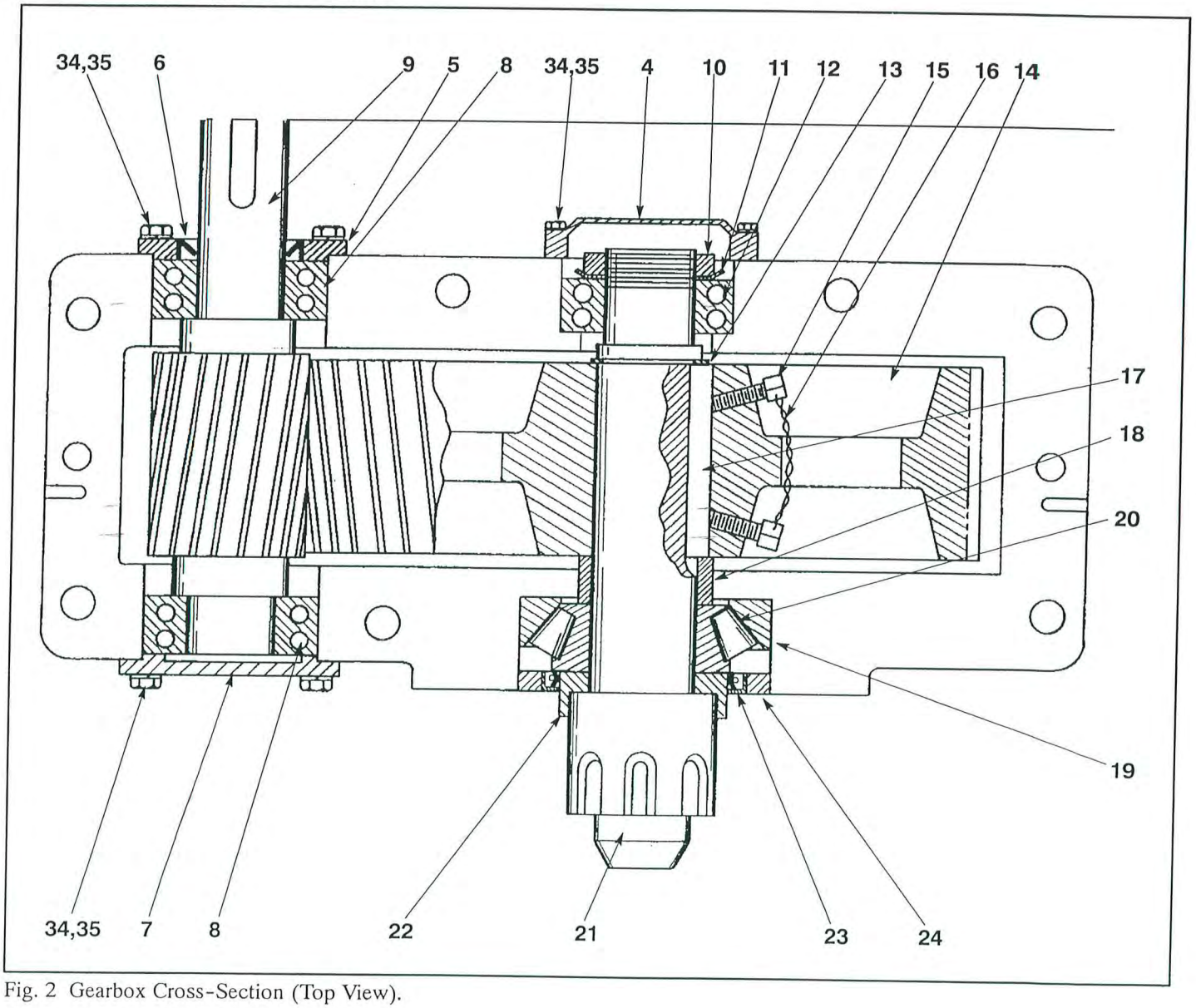


Fig. 2 Gearbox Cross-Section (Top View).

12. Press main shaft from bull gear. It may be necessary to heat the hub of bull gear, especially if the gearbox has been operated for a long period of time under severe operating conditions.
13. Remove spacer (18) from main shaft.
14. Remove bearing cup and bearing cone (19, 20).
15. Remove wear collar (22).
16. Remove pinion shaft bearings (8) from pinion shaft.

INNER SEAL REPLACEMENT (Main Shaft)

1. With hopper and adapter plate removed, use a hooded tool to pull inner seal and seal adapter ring from gearbox.
2. Clean cavity and use a sealant coating on outer rim of new seal. Press new seal into seal adapter ring before tapping back in place. Lip of seal must face inward (Fig. 2). Install flush with gearbox face.

CLEANING AND INSPECTION OF PARTS

CAUTION: Do not spray high pressure water or steam directly against outer or inner seal. Water may be forced past the seal(s) and into gearbox.

Clean all parts, including inside of housing halves, thoroughly with a U.S.D.A. approved solvent.

Check for damage or excessively worn gear teeth and bearings. If bearing condition is doubtful, replace them. DO NOT RE-USE PITTED BEARINGS.

Always replace all seals and wear collar (22) during major overhaul of gearbox.

NOTE: If one side of gear teeth on bull gear are badly worn, the gear can be turned around so the unused side of the teeth can be used. In this case, a new pinion gear must be installed. Replace gears if any teeth are broken.

Check and clean out breather pipe opening.

Remove, clean and re-install magnetic drain plug.

GEARBOX RE-ASSEMBLY

Make sure all parts are thoroughly cleaned before re-assembling.

1. Prepare the main shaft/bull gear/bearing assembly as follows:
   a. Preheat wear collar (22) to 200°-250° F before installing. Install tight against shoulder of main shaft (Fig. 2).

CAUTION: Overheating wear collar will damag chrome plating.

   b. Install bearing cone (20) tight against we collar.
   c. Install bearing cup (19).
   d. Install main shaft spacer (18) tight agair cone.
   e. Install key (17) in shaft against collar, maki sure it is "bottomed" in the key slot. IM **PORTANT:** Make sure set screws do n protrude through inside of gear key way. R move them to make sure.
   f. It may be necessary to heat the gear hu evenly to about 250°-300° F before installin main shaft. A press may be required.
   g. When installing main shaft, make sure th square key does not slip out of position.
   h. Press bull gear tight against spacer colla Thread set screws in place and tighten.
   i. **IMPORTANT:** Tighten set screws (15) an install lock wire (16). FINAL PRE-LOAI MUST BE DONE AFTER INSTALLINC TOP HOUSING HALF.
   j. Install snap ring (13), making sure it is com pletely "bottomed" in the groove.
   k. Install pilot bearing (12).
   l. Install tabbed washer and lock nut (11, 10) loosely (to be torqued later).
   m. Lift entire assembly into lower housing, positioning outer bearing races. Check for proper seating.
   n. Tighten lock nut (10) to temporarily pre-position all parts and remove any slack between bearing outer races and housing shoulders. Loosen lock nut to remove all pre-load.
2. Install two pinion bearings (8) onto each end of pinion gear shaft and install this assembly as shown in Fig. 3.
3. Temporarily install pinion end cap (7) with two screws. This will assure proper position of the front bearing.
4. Temporarily install seal carrier (5) to properly position rear pinion bearing. Remove seal carrier and pinion end cap.
5. Apply Permatex** (or equivalent) sealing compound on mating surface of lower housing. **CAUTION: Do not use silicone type sealing**

compound in this area, as oil passages to bearings could be plugged causing premature gearbox failure.

6. With a hoist, lift upper housing half and place on lower housing.
7. Install dowel pins (3) but do not hammer in yet. This will properly align upper and lower housing halves.
8. Install main shaft seal and seal carrier flush with face of gearbox. (Too far in will close oil passage).
9. Secure housing halves with nine cap screws and hex nuts (29, 30). Torque down evenly to 90 ft. lbs.
10. Tap dowel pins in with hammer. One rap each.
11. Install pinion end cap (7).
12. Install oil seal and seal carrier (6, 5). See PINION SHAFT OIL SEAL REPLACEMENT on page 2.
13. Pre-load main shaft thrust bearing as follows:
    a. Torque lock nut (10) to 80 ft. lbs., then loosen completely and re-torque to 10-15 ft. lbs.
    b. Secure lock nut by bending a tab of the lock washer (21) into slot in lock nut.

CAUTION: FAILURE TO SECURE LOCK NUT WITH LOCK WASHER WILL RESULT IN ULTIMATE GEARBOX DAMAGE.

14. Apply silicone* type sealing compound to pilot bearing cover (4) and install with cap screws.

GEARBOX OILER ASSEMBLY

After gearbox is completely assembled, screw in two lubricator studs on each side of gearbox upper housing half (total of four) as shown in Fig. 3. Coat stud and inner face of nut with an oil-proof sealant. Screw in stud until it comes in contact with bull gear, then loosen one half turn. Tighten nut against housing. Make sure slot in stud is VERTICAL.

FINAL INSPECTION, LUBRICATION AND ASSEMBLY

1. ADD OIL. See LUBRICATION on page 1.
2. Apply silicone* type sealing compound to inspection cover mating surfaces. Install inspection cover (1).
3. Re-check tightness of all bolts and nuts.

***SILICONE TYPE SEALING COMPOUND (or equivalent):** Silicone type sealing compound should be used in this location to assure a more permanent seal.

****PERMATEX SEALING COMPOUND (or equivalent):** Permatex type sealing compound should be used at these locations rather than silicone to prevent plugging of "bearing oil passages" and allow easier disassembly when rebuilding is required.

WEILER® GEARBOX MODELS: 1398-5, 1398-5HA, 1398-5HB 1992-5HA, 1992-5HB

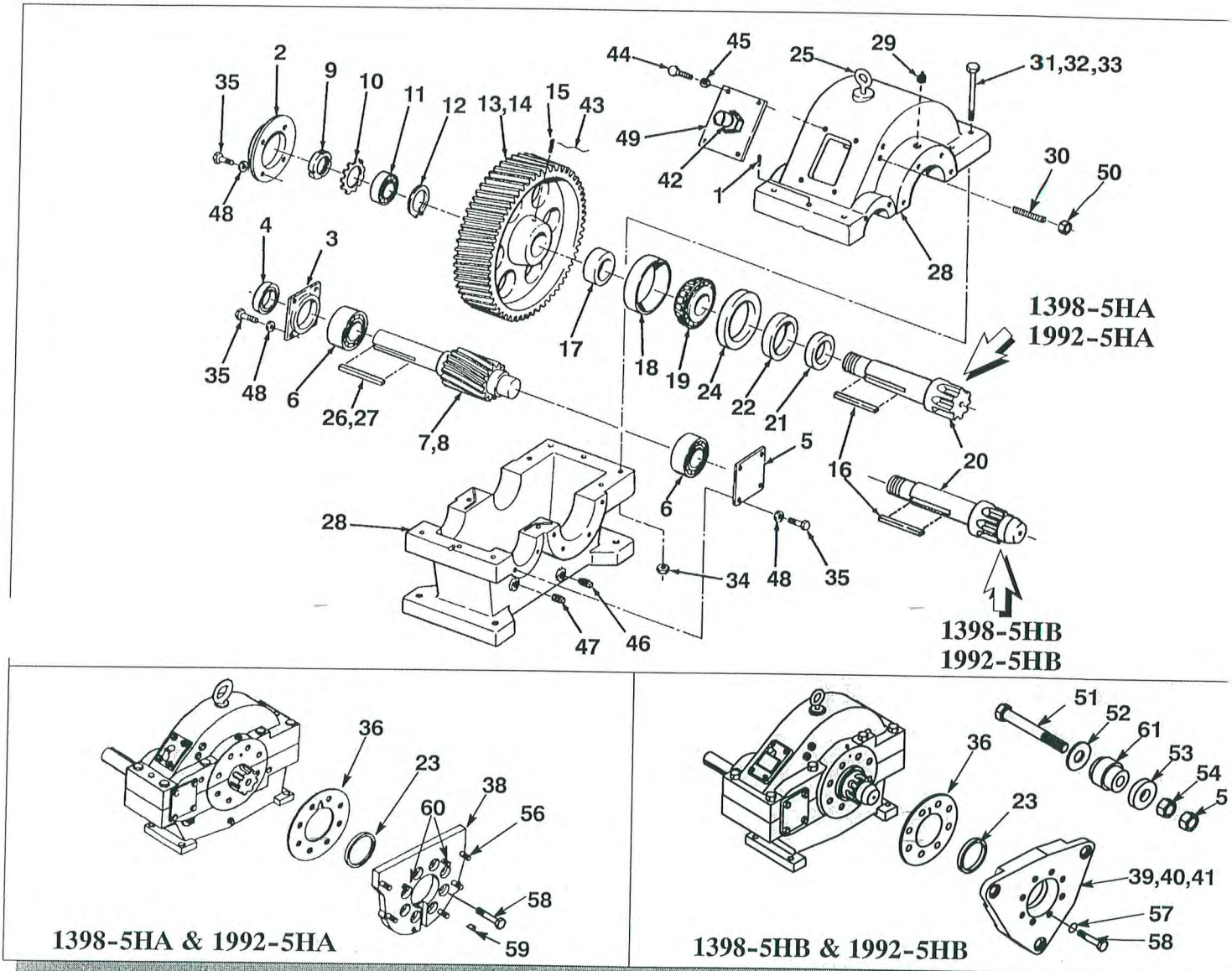


Fig. 3 1398-5, 1398-5HA, 1398-5HB, 1992-5HA,1992-5HB Gearbox Exploded View.

MODEL 1398 & 1992 GEARBOX ASSEMBLY

GEARBOX MODEL	WITH ADAPTER PLATE	WITHOUT ADAPTER PLATE
1398-5*	----	----
1398-5HA with 113-1392 Adapter Plate	114-2443	114-1115
1398-5HB with 113-2428 Adapter Plate (1675 Tilted)	114-2460	114-1116
1398-5HB with 113-2103 Adapter Plate (1675 Vertical)	114-2461	114-1116
1398-5HB with 113-0899 Adapter Plate	114-2445	114-1116
1992-5HA with 113-1392 Adapter Plate	114-2442	114-1113
1992-5HB with 113-2428 Adapter Plate (1675 Tilted)	114-2463	114-1117
1992-5HB with 113-2103 Adapter Plate (1675 Vertical)	114-2462	114-1117
1992-5HB with 113-0899 Adapter Plate	114-2444	114-1117

*1398-5 Gearbox is discontinued but parts are available. Can be converted to -5HA or -5HB.

WEILER® GEARBOX MODELS: 1398-5, 1398-5HA, 1398-5HB 1992-5HA, 1992-5HB

ITEM	PART NUMBERS					DESCRIPTION	QTY
	1398-5	1398-5HA	1398-5HB	1992-5HA	1992-5HB		
1	014-1124	014-1124	014-1124	014-1124	014-1124	PIN, DOWEL, #8 x 4-1/2"	2
2	114-1329	114-1329	114-1329	114-1329	114-1329	COVER, PILOT BEARING	1
3	114-1331	114-1331	114-1331	114-1399	114-1399	CARRIER, SEAL	1
4	024-1332*	024-1332*	024-1332*	024-1403*	024-1403*	SEAL, OIL, PINION	1
5	114-1330	114-1379	114-1379	114-1379	114-1379	END CAP, PINION	1
6	022-1342*	022-1342*	022-1342*	022-1381*	022-1381*	BEARING, PINION	2
7	026-1373	026-1373	026-1373	----	----	GEAR, PINION, 13 TOOTH	1
8	----	----	----	026-1372	026-1372	GEAR, PINION, 19 TOOTH	1
9	010-1344*	010-1344*	010-1344*	010-1344*	010-1344*	LOCK NUT	1
10	010-1345*	010-1345*	010-1345*	010-1345*	010-1345*	WASHER, TABBED LOCK	1
11	022-1346*	022-1346*	022-1346*	022-1346*	022-1346*	BEARING, PILOT	1
12	010-1347*	010-1347*	010-1347*	010-1347*	010-1347*	SNAP RING	1
13	026-1396	026-1396	026-1396	----	----	GEAR, BULL, 98 TOOTH	1
14	----	----	----	026-1383	026-1383	GEAR, BULL, 92 TOOTH	1
15	114-1361	114-1361	114-1361	114-1361	114-1361	SET SCREW, 5/8"-11 x 1-1/2"	2
16	114-1397*	114-1384*	114-1384*	114-1384*	114-1384*	KEY, 7/8" SQ. x 5" (1398-5 Key: 3/4" x 7/8")	1
17	114-1350*	114-1385*	114-1385*	114-1385*	114-1385*	SPACER, MAIN SHAFT	1
18	022-1351*	022-1351*	022-1351*	022-1351*	022-1351*	CUP, BEARING	1
19	022-1352*	022-1352*	022-1352*	022-1352*	022-1352*	CONE, BEARING	1
20	NOTE	114-1391*	114-0898*	114-1391*	114-0898*	MAIN SHAFT	1
21	114-1388*	114-1388*	114-1388*	114-1388*	114-1388*	WEAR COLLAR	1
22	024-1386*	024-1386*	024-1386*	024-1386*	024-1386*	SEAL, OIL, INNER	1
23	----	024-1394*	024-1394*	024-1394*	024-1394*	SEAL, OIL, OUTER	1
24	114-1387	114-1387	114-1387	114-1387	114-1387	RING, SEAL ADAPTER	1
25	014-1077	014-1077	014-1077	014-1077	014-1077	LIFTING EYE, 5/8"-11	1
26	114-1328	114-1328	114-1328	----	----	KEY, 1/2" SQ. x 6"	1
27	----	----	----	114-2374	114-2374	KEY, 5/8" SQ. x 6"	1
28	114-5046	114-5046	114-5046	114-5046	114-5046	HOUSING ASSY, UPPER & LOWER	1
29	010-1269	010-1269	010-1269	010-1269	010-1269	FITTING, LUBE, 1/4" NPT	1
30	114-2096	114-2096	114-2096	114-2096	114-2096	STUD, LUBRICATION	4
31	010-2686	010-2686	010-2686	010-2686	010-2686	BOLT, HEX, 5/8-18 x 8"	7
32	010-2687	010-2687	010-2687	010-2687	010-2687	BOLT, HEX, 5/8-18 x 9-1/2"	1
33	010-2688	010-2688	010-2688	010-2688	010-2688	BOLT, HEX, 5/8-18 x 11"	1
34	010-2689	010-2689	010-2689	010-2689	010-2689	NUT, HEX, 5/8-18	9
35	010-1048	010-1048	010-1048	010-1048	010-1048	BOLT, HEX, 1/2-13 x 1-1/4"	12
36	024-1152*	024-1152*	024-1152*	024-1152*	024-1152*	GASKET, ADAPTER TO GEARBOX	1
37	118-3127*	118-3127*	118-3127*	118-3127*	118-3127*	WRENCH, G.BOX MAIN SHFT (Not Shown)	1
38	113-1392N	113-1392N	----	113-1392N	----	ADAPTER PLATE, Standard (HA SPLINE)	1
39	----	----	113-0899N	----	113-0899N	ADAPTER PLATE, Standard (HB SPLINE)	1
40	----	----	113-2428N	----	113-2428N	ADAPTER PLATE, Standard (HB SPLINE TILTED)	1
41	----	----	113-2103N	----	113-2103N	ADAPTER PLATE, Standard (HB SPLINE VERT)	1
42	014-1120	014-1120	014-1120	014-1120	014-1120	VENT, BREATHER	1
43	114-1035	114-1035	114-1035	114-1035	114-1035	LOCK WIRE	1
44	010-1118	010-1118	010-1118	010-1118	010-1118	CAP SCREW, 3/8-16 X 1"	4
45	010-1164	010-1164	010-1164	010-1164	010-1164	LOCK WASHER, 3/8"	4
46	014-1057	014-1057	014-1057	014-1057	014-1057	PLUG, OIL DRAIN, 1/2-NPT	1
47	014-1058	014-1058	014-1058	014-1058	014-1058	PLUG, OIL LEVEL CHECK	1
48	010-1157	010-1157	010-1157	010-1157	010-1157	LOCK WASHER, 1/2"	8
49	114-1326	114-1326	114-1326	114-1326	114-1326	COVER, INSPECTION	1
50	010-1204	010-1204	010-1204	010-1204	010-1204	NUT, HX 5/8-11	4
51	----	----	010-1103	----	010-1103	CAP SCREW, 1-1/4-12 X 6-1/2"	3
52	----	----	010-1184	----	010-1184	FLAT WASHER, 1-1/4"	3
53	----	----	113-0900N	----	113-0900N	WASHER, THICK	3
54	----	----	010-1207	----	010-1207	NUT, HEX 1-1/4-12	3
55	----	----	010-1220	----	010-1220	NUT, JAM 1-1/4-12	3
56	114-1139	114-1139	----	114-1139	----	STUD, 3/4-10 X 3"	6
57	----	----	010-1160	----	010-1160	LOCK WASHER, 7/8"	8
58	010-1088	010-1088	010-1091	010-1088	010-1091	CAP SCREW, 7/8-9	8
59	114-1395	114-1395	----	114-1395	----	LOCK, CAP SCREW	8
60	114-1085	114-1085	----	114-1085	----	STUD, 3/4-10 X 2-1/2"	2
61	----	----	113-0901SS	----	113-0901SS	SPACER	3

NOTE: 1398-5 Gearbox repair kits are available with main shaft only and will be converted to 1398-5HA. *Parts Included in Gearbox Repair Kit

MODEL 1398 & 1992 GEARBOX REPAIR KITS:

GEARBOX MODEL	W/ MAIN SHAFT	W/O MAIN SHAFT	GEARBOX MODEL	W/ MAIN SHAFT	W/O MAIN SHAFT
1398-5HA	114-2470	114-2471	1992-5HA	114-2469	114-2468
1398-5HB	114-2467	114-2466	1992-5HB	114-2464	114-2465

RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 3
Raw/Surge Bin

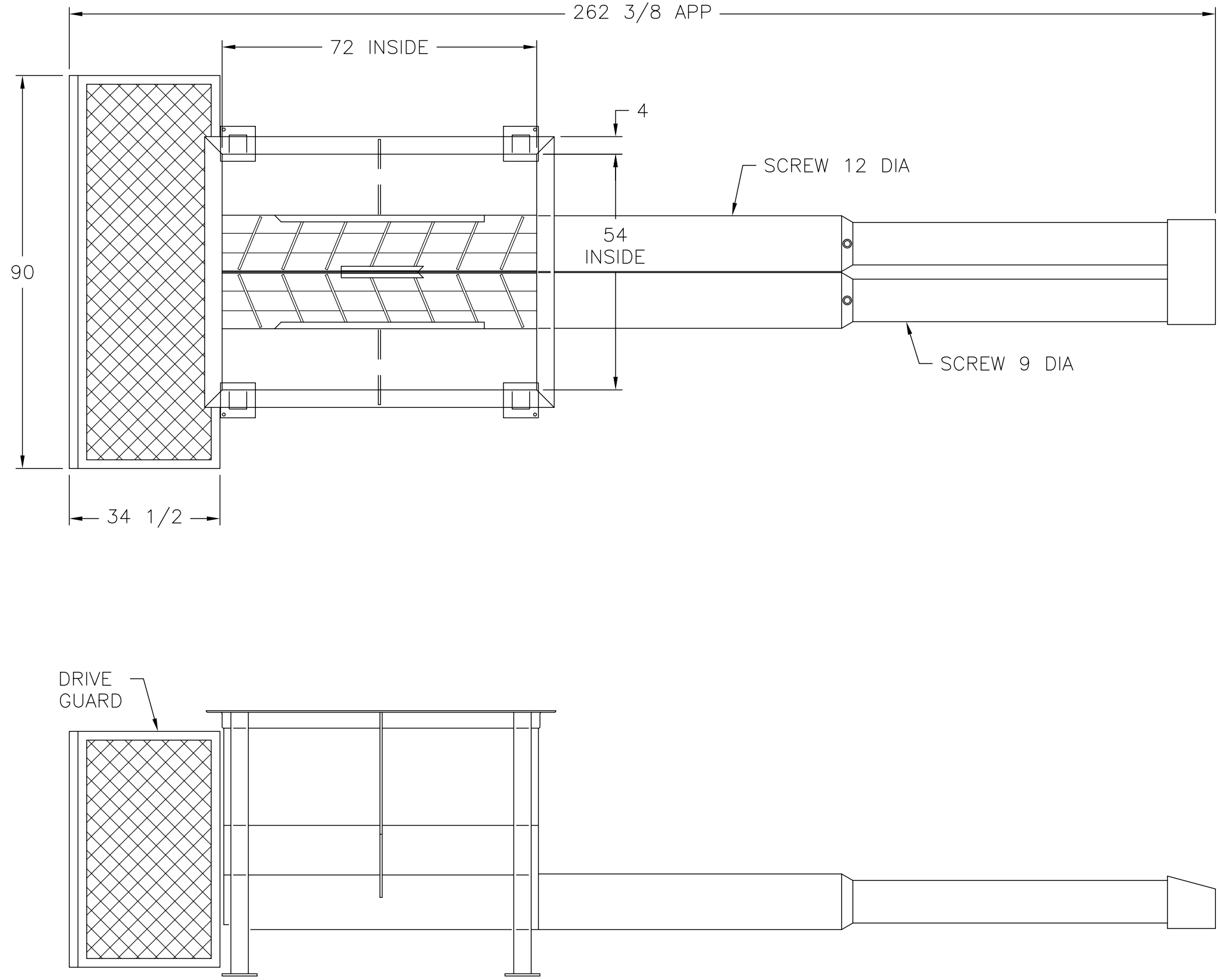
1813 Frank Holt Drive Burlington NC 27215 336-226-1100 rendeq.com

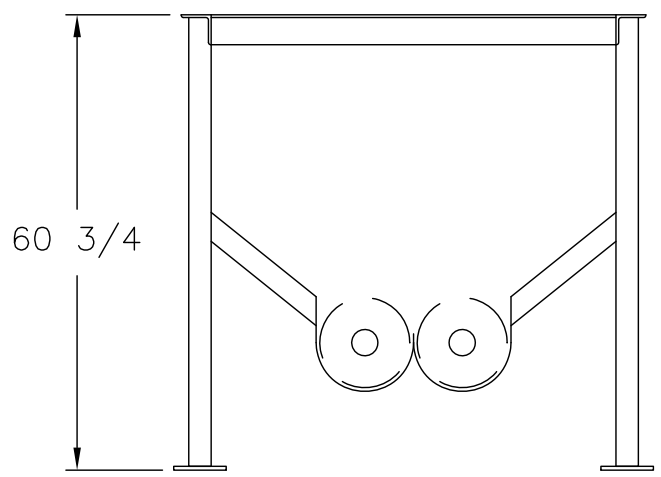
RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC. GTAF System
RAW/SURGE BIN

Item	Qty	Part Numbers/ Description
Bearings	2	Dodge 023113
Level Switches	2	Model: AB-R
Chain	~20ft.	80 Single Riveted Roller Chain
Motors	2	(1)Baldor M2280T, (1) Leeson
Gearboxes	2	Conedrive H054204-2 40:1 Ratio
Sprockets	3	(1) Dodge 100619 (1) Dodge 100595 (1)Martin 80BTB70
Shafts	2	3in Machined
Bushings	2	Dodge 117134
Thermocouples	2	Type K





DRIVE GUARD NOT
SHOWN IN THIS VIEW

Instruction Manual for Dodge Type E Bearings

These instructions must be read thoroughly before installation or operation.

WARNING: To ensure the drive is not unexpectedly started, turn off and lock-out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

INSTALLATION:

1. Clean shaft and bore of bearing. Lubricate with light oil or anti seize compound.
2. Slip bearing in position.
3. Bolt bearing to support, using shims where necessary to align bearing.
4. Tighten setscrews to the torque values shown on Table 1.
5. The effort required to turn the shaft should be the same before and after bolting bearing to the support.

Table 1 - Set Screw Torque Table

Shaft Size (inches)	Set Screw Size	Tightening Torque
1- 3/16 – 1-11/16	5/16 – 18	165 in–lbs
1-3/4 – 2-1/2	3/8 – 16	290 in–lbs
2-11/16 – 3-1/2	1/2 – 13	620 in–lbs
3 15/16 – 5	5/8 – 11	1325 in–lbs
5-7/16 – 6	3/4 – 10	2150 in–lbs
6-7/16 – 7	7/8 – 9	5130 in–lbs
Shaft Size (mm)	**Set Screw Size**	**Tightening Torque**
35–40mm	M8	17.8 NM
45–65mm	M10	35 NM
70–75mm	M12	57 NM
80–90mm	M12	57 NM
100–125mm	M16	126 NM

Lubrication Guidelines

This bearing is factory lubricated with a lithium or lithium complex base grease which is suitable for most applications. However, extra protection is necessary if the bearing is subjected to excessive moisture, dust, corrosive vapor or other harsh environments. In these cases, the bearing should contain as much grease as speed will permit (a full bearing with consequent slight leakage through the seal is the best protection against contaminant entry).

For relubrication, select a grease that is compatible with a lithium or lithium complex grease. The following table is a general guide for normal operating conditions. However, some situations may require a change in lubricating periods as dictated by experience.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a fail safe device must be an integral part of the driven equipment beyond the speed reducer output shaft.

Generally, a lower quantity of grease at frequent intervals is more effective than a greater quantity at extended lubrication intervals.

Lubrication Guide (in weeks)

Read Preceding Paragraphs Before Establishing Lubrication Schedule

Hours Run per Day	1 to 250 RPM	251 to 500 RPM	501 to 750 RPM	751 to 1000 RPM	1001 to 1500 RPM	1501 to 2000 RPM	2001 to 2500 RPM	2501 to 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	2	1
24	10	5	3	2	1	1	1	1

Lubrication recommendations are intended for standard products applied in general operating conditions. For modified products, high temperature environments and other anomalous applications, contact product engineering at 864.284.5700.

Storage or Special Shutdown

If exposed to wet or dusty conditions or to corrosive vapors, extra protection is necessary. Add grease until it shows at the seals; rotate the bearing to distribute grease; cover the bearing. After storage or idle period, add a little fresh grease before running.

High Speed Operation

In the higher speed ranges too much grease will cause overheating. The amount of grease that the bearing will take for a particular high speed application can be determined only by experience — see “Operating Temperature” below. If excess grease in the bearing caused overheating, it will be necessary to remove grease fitting to permit excess grease to escape. The bearing has been greased at the factory and is ready to run. When establishing a relubrication schedule, note that a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals.

Operation in Presence of Dust, Water or Corrosive Vapors

Under these conditions the bearing should contain as much grease as speed will permit, since a full bearing with consequent slight leakage is the best protection against entrance of foreign material. In the higher speed ranges too much grease will cause overheating — see “High Speed Operation.” In the lower speed ranges it is advisable to add extra grease to a new bearing before putting into operation. Bearings should be greased as often as necessary (daily if required) to maintain a slight leakage at the seals. For extreme conditions or dust and/or moisture consider adding a supplemental sealing system with the E-TECT seal kits. See catalog for details.

Average Operation

This bearing has been greased at the factory and is ready to run. The table above is a general guide for relubrication. However, certain conditions may require a change of lubricating periods as dictated by experience. See “High Speed Operation” and “Operating in Presence of Dust, Water, or Corrosive Vapors.”

BALDOR • DODGE®

Operating Temperature

Abnormal bearing temperature may indicate faulty lubrication. Normal temperature may range from “cool to warm to the touch” up to a point “too hot to touch for more than a few seconds,” depending on bearing size and speed, and surrounding conditions. Unusually high temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seems noisy, usually indicates too little grease. Normal temperature and a slight showing of grease at the seals indicate proper lubrication.

Kind of Grease

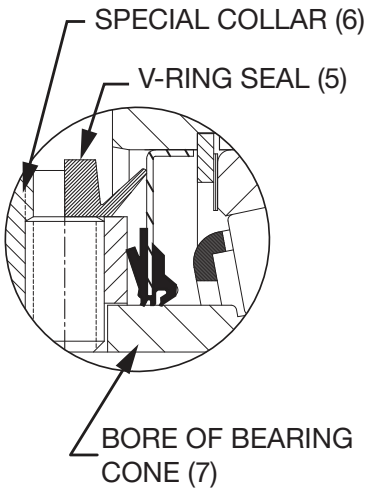
Many ordinary cup greases will disintegrate at speeds far below those at which DODGE bearings will operate successfully if proper grease is used. DODGE bearings have been factory lubricated with an NLGI #2 lithium complex base grease. Relubricate with Lithium complex-base grease or a grease which is compatible with original lubricant and suitable for roller bearing service. In unusual or doubtful cases the recommendation of a reputable grease manufacturer should be secured.

E-TECT SEAL KIT: Added Protection for Extremely Wet and Dirty Environments

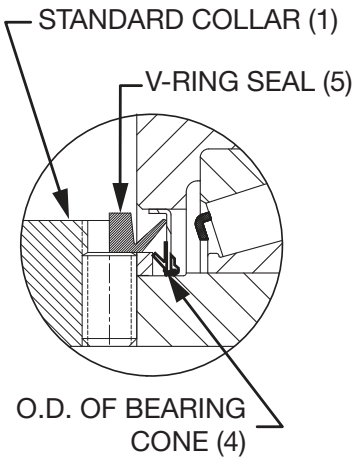
A V-ring seal is added to the standard “R” seal system. The V-ring is held in place by the locking collar. The V-ring has face rubbing contact with the steel “R” seal carrier. The resulting system puts a flinger collar, V-ring seal, clearance seal, lip seal and two grease dams between the rollers and the outside environment. All components are designed for optimum sealing and purging action.

Type K, DOUBLE-INTERLOCK, TAF and E-XTRA E-TECT Seal Kits	
Shaft Size Inches	**Kit Part* Number**
1-3/16 to 1-1/4	037650
1-3/8 to 1-7/16	037651
1-1/2 to 1-11/16	037652
1-3/4 to 2	037653
2-3/16	037654
2-1/4 to 2-1/2	037655
2-11/16 to 3	037656
3-3/16 to 3-1/2	037657
3-5/16 to 4	037658
4-7/16 to 4-1/2	037659
4-15/16 to 5	037660
5-7/16 to 6	037673**
6-7/16 to 7	037674**

* Kit includes one collar, special set screws and seal.
** Kit for 5-7/16 to 7” consists of a modified V-ring seal only.
For Type K bearings, E-TECT Seal may be used on collar side only.
For Double-Interlock, TAF and E-XTRA, two kits are required (one for each collar)



E-TECT SEAL - 1-3/16 through 5”



E-TECT SEAL - 5-7/16 through 7”

Special Operating Conditions

Refer acid, chemical, extreme or other special operating conditions to Baldor Electric, Dodge Product Support, Greenville, SC (864-284-5700).

BALDOR
A MEMBER OF THE ABB GROUP

P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895

Dodge Product Support

6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433

MN3012 (Replaces 499791, and 499792, 499793)

www.baldor.com

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IOM
LAA180313 Rev. B

Bin-Dicator®
Installation & Operation Manual

Bin-Dicator®
Installation & Operation Manual

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SAFETY SYMBOLS

WARNING:

IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS INJURY. RISK OF ELECTRICAL SHOCK.

CAUTION:

IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS DAMAGE OR FAILURE OF THE EQUIPMENT.

Bin-Dicator®
Installation & Operation Manual

I. HANDLING AND STORAGE

SAVE THESE INSTRUCTIONS

INSPECTION AND HANDLING

Do not dispose of the carton or packing materials.

Each package should be inspected upon receipt for damage that may have occurred due to mishandling during shipping. If the unit is received damaged, notify the carrier or the factory for instructions. Failure to do so may void your warranty. If you have any problems or questions, consult Customer Support at 1-800-778-9242.

DISPOSAL AND RECYCLING

This product can be recycled by specialized companies and must not be disposed of in a municipal collection site. If you do not have the means to dispose of properly, please contact for return and disposal instructions or options.

STORAGE

If the device is not scheduled for immediate installation following delivery, the following steps should be observed:

1. Following inspection, repackage the unit into its original packaging.
2. Select a clean dry site, free of vibration, shock and impact hazards.
3. If storage will be extended longer than 30 days, the unit must be stored at temperatures between 32º and 104º F (0º to 40° C) in non-condensing atmosphere with humidity less than 85%.

CAUTION: DO NOT STORE A NON-POWERED UNIT OUTDOORS FOR A PROLONGED PERIOD.

II. GENERAL SAFETY

AUTHORIZED PERSONNEL

All instructions described in the document must be performed by authorized and qualified service personnel only. Before installing the unit, please read these instructions and familiarize yourself with the requirements and functions of the device. The required personal protective equipment must always be worn when servicing this device.

USE

The device is solely intended for use as described in this manual. Reliable operation is ensured only if the instrument is used according to the specifications described in this document. For safety and warranty reasons, use of accessory equipment not recommended by the manufacturer or modification of this device is explicitly forbidden. All servicing of this equipment must be performed by qualified service personnel only. This device should be mounted in locations where it will not be subject to tampering by unauthorized personnel.

MISUSE

Improper use or installation of this device may cause the following:

- Personal injury or harm
- Application specific hazards such as vessel overfill
- Damage to the device or system

If any questions or problems arise during installation of this equipment, please contact Customer Support at 800-778-9242.

III. PRODUCT DESCRIPTION

FUNCTION

Bin-Dicator® diaphragm-type level controls were the original electromechanical point level switches and the first to enjoy general usage in the industry. Bin-Dicator controls eliminate bin overflow, empty bins, clogged conveyors, choked elevators and the resulting damage and waste.

The Bin-Dicator control is a pressure actuated switch for use with free flowing bulk materials at atmospheric pressures. Actuation of the switch is the result of pressure exerted by the bulk material against the diaphragm assembly. De-actuation or switch release is a result of the bulk material clearing away from the diaphragm.

FEATURES

Bantam Bin-Dicator

- 5¾” diameter
- 2 diaphragm material options
- Light duty

Auto-Bin-Dicator

- 8” diameter
- Cast aluminum housing
- Neoprene or SS diaphragm material
- Medium duty

Model ‘A’

- 10¼” diameter
- Explosion proof model avail.
- 7 diaphragm material options
- Heavy duty

TECHNICAL SPECIFICATIONS

FUNCTIONAL

Switch Standard 185º F (85º C)	Model-A	SPDT: 15 amp resistive @ 250 VAC
	Auto-Bin-Dicator	Standard SPDT Snap Action Switch (Dry Rated): 15 amp resistive @ 125, 250 or 480 VAC; Pilot duty 375 VA, 125 VAC or 750 VA, 250 VAC
	Bantam	SPDT: 20 amp resistive @ 250 VAC
Optional Switches	Ratings	250º F (121º C), 800º F (427º C)
	Explosion Proof	Model-A and Auto-Bin-Dicator
Temperature		1.0 of calibrated span (combined linearity, hysteresis, stability) between 0º and 150º F
		32º F to185º F (0º to 85º C) standard, Auto and Bantam
Frame	Polyester-coated aluminum casting	
Cover	Polyester-coated aluminum casting (Auto and Bantam)	
	Standard durable ABS white plastic (Model “A”)	
Construction	Weather-proof or explosion-proof (Auto)	
Diaphragms	Neoprene, Stainless Steel (Auto), Aluminum (Bantam), Steel galvanized back plate; Steel polyester washer (Model “A”)	
Gasket	Rubber (Bantam), Fiber (Model “A”)	
Mounting	Can be mounted on underslopes up to 45 degree (Bantam & Model “A”)	
Shipping Weight	Aluminum 8 lbs (Auto & Bantam), Aluminum 10 lbs (Model “A”)	
Pollution Degree	2	
Installation Category	II	
Altitude	6,526 ft (2000 m)	

DIAPHRAGM MATERIAL	MAX. TEMP	PRODUCT WT. Cu./Ft.	APPLICATION REMARKS
Neoprene Rubber (light)	170° F (77° C)	10-40	Highest sensitivity, abrasion resistant
Neoprene Rubber (medium)	170° F (77° C)	30-100	Strong, resists abrasion, low temperatures
Neoprene Rubber (heavy)	170° F (77° C)	100-350	Strong, resists abrasion, low temperatures
Canvas	200° F (93° C)	10-60	Powders only
Fiberglass	1000° F (538° C)	25-100	Very high temp-see switch temperatures
T-302 SS	800° F (427° C)	30 Min.	Auto-Bin-Dicator® only
Silicone Rubber (heavy)	450° F (232º C)	50-150	Extreme low to medium-high temperature
Teflon® Coated Fiberglass (heavy)	400° F (204º C)	50-150	Corrosion resistant, medium-high temperatures

Note: For high temperature applications, special switches may be required in addition to proper diaphragm selection. Please consult factory.

APPROVALS - CONSULT FACTORY FOR SPECIFIC MODEL LISTING

General Purpose: UL, CSA

Hazardous Location:

UL: Class 1, Groups C & D, Class II, Groups E, F, G

IV. MECHANICAL INSTALLATION

WARNING: REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS.

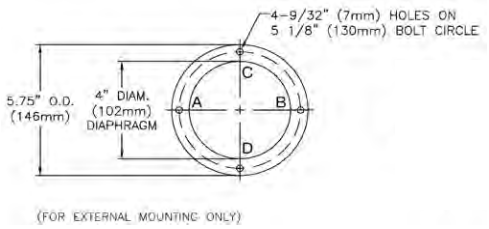
BANTAM

GUIDELINES

- Should be located at a point where the material will normally reach and actuate the diaphragm, and when receding, will completely clear the diaphragm.
- Mounting location should be out of the direct flow of material into the vessel.

MOUNTING

CAUTION: FOR ALL ANGLES OF MOUNTING, LINE C-D MUST BE IN A VERTICAL PLANE AND LINE A-B MUST BE HORIZONTAL.



1. Lay out 4 and 5 ⅛ in. (10 and 13 cm) concentric circles at point where the Bantam Bin-Dicator device is to be mounted.
2. Cut out the 4 in. (10 cm) circle and drill four 9/32 in. holes on the 5 ⅛ in. (13 cm) circle.
3. Insert gasket between vessel wall and face of the unit.
4. Fasten to vessel wall with ¼” mounting bolts.
5. Check operation of lever system and switch; make field adjustments as necessary.
6. Connect conduit and make wiring connections.
7. Replace cover.

FIELD ADJUSTMENT

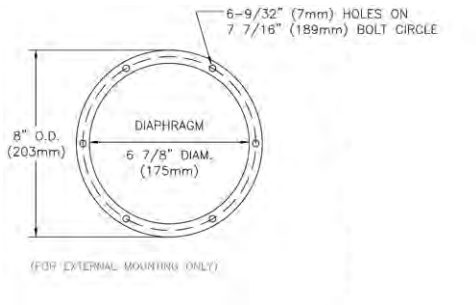
1. Check for binding at the pivot points. If binding is occurring, it is likely due to improper mounting. Check to be sure the lever alarm is in a vertical plane and that the mechanism operates freely.
2. Adjust the counterweight. For reliable operation of the counterweight must be sufficient to return the diaphragm to normal position when the material completely clears the diaphragm. To adjust the counterweight, loosen the nuts holding the segments in place. Move the weight toward the lever arm to decrease the counterweight. To increase the counterweight, move the weight away from the lever arm. Be sure to lock the counterweight at the desired position.
3. Check switch sensitivity. Switch may be adjusted for more sensitive operation by loosening the top machine screw holding the switch in place and shifting the position of the switch to obtain the desired sensitivity. When making this adjustment, be sure the switch returns to normal when the level plate is slowly lowered by hand.

AUTO-BIN-DICATOR

GUIDELINES

- High Level Mounting: unit should be mounted low enough on the vessel wall, so that material will normally cover the diaphragm and provide sufficient head of material before the high level signal is required.
- Low Level Mounting: unit should be mounted high enough on the vessel wall, so that material in its normal flow will cover the diaphragm and provide sufficient head of material before the low level signal is required.
- Mounting location should be out of the direct flow of material into the vessel.

MOUNTING



1. Mark two concentric circles on the vessel wall at the point where the unit is to be mounted. One circle should be 6 7/8 in. (17 cm) in diameter, the second 7 7/16 in. (19 cm) in diameter.
2. Cut out the 6 7/8 in. (17 cm) circle.
3. Lay out six (6) equally spaced holes on the 7 7/16 in. (19 cm) circle.
4. Drill or tap 1/4 in. for bolts or cap screws.

5. Insert the gasket between the vessel wall and the flange of the unit with the conduit entry facing downward.
6. Fasten the unit to the vessel wall with ¼ in. bolts or cap screws.
7. Connect conduit and make wiring connections at switch terminals.
8. Screw cover to housing securely to prevent damage or moisture.
9. Check switch operation by manually depressing diaphragm and releasing. The switch should now respond to the pressure.

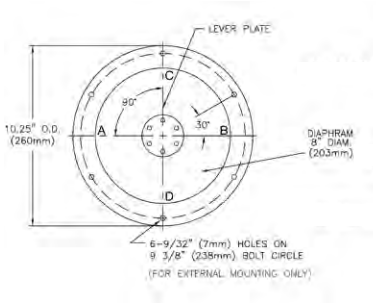
MODEL 'A' (Standard or with Mercury Switch)

GUIDELINES

- Should be located at a point where the material in its normal flow will reach and move the diaphragm, and when receding, will completely clear the diaphragm.
- Mounting location should be out of the direct flow of material into the vessel.
- If the material is of lighter density or if the unit is to be mounted on the under-slope, the counterweight must be reduced to provide sensitive operation of the unit.
- If the material is of heavier density or if the unit is mounted on the under-slope, the counterweight must be increased to return the diaphragm to normal as the material clears the diaphragm.

MOUNTING

CAUTION: WHEN MOUNTING LINE C-D MUST BE ON A VERTICAL PLANE AND LINE A-B MUST BE HORIZONTAL.



1. Mark two concentric circles on the vessel wall at the point where the unit is to be mounted. One circle should be 8 in. (20 cm) in diameter, the second 9⅜ in. (24 cm) in diameter.
2. Cut out the 8 in. (20 cm) circle.
3. Lay out six (6) equally spaced holes on the 9⅜ in. (24 cm) circle.
4. Drill or tap ¼ in. bolts or cap screws.
5. Insert the gasket between the vessel wall and the flange of the unit with the conduit facing down.
6. Fasten the unit to the vessel wall with ¼ in. bolts or cap screws.

7. Check operation of lever system and switch; make field adjustments as necessary.
8. Connect conduit and make wiring connections.
9. Replace cover.

FIELD ADJUSTMENT

1. Check for binding at the pivot points. If binding is occurring, it is likely due to improper mounting. Check to be sure the lever alarm is in a vertical plane and that the mechanism operates freely.
2. Adjust the counterweight. For reliable operation of the counterweight must be sufficient to return the diaphragm to normal position when the material completely clears the diaphragm. To adjust the counterweight, loosen the nuts holding the segments in place. Ad or remove counterweight washers to adjust.
3. Check switch sensitivity. Switch may be adjusted for more sensitive operation by loosening the top machine screw holding the switch in place and shifting the position of the switch to obtain the desired sensitivity. When making this adjustment, be sure the switch returns to normal when the level plate is slowly lowered by hand.

Figure 1. General Component Layout

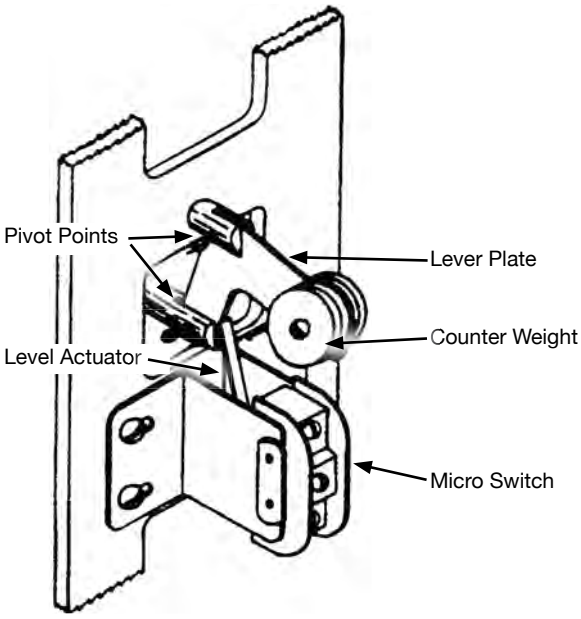
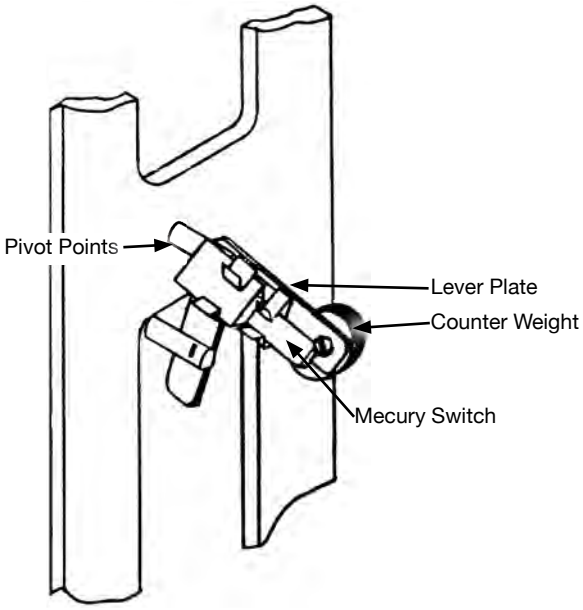


Figure 2. Mercury Switch Component Layout



V. ELECTRICAL INSTALLATION

WARNING: VERY HIGH VOLTAGE IS PRESENT. REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS

GENERAL SAFETY

When using electrical equipment, you should always follow basic safety precautions, including the following:

- The installation and wiring of this product must comply with all national, federal, state, municipal, and local codes that apply.
- Properly ground the enclosure to an adequate earth ground.
- Do not modify any factory wiring. Connections should only be made to the terminals described in this section.
- All connections to the unit must use conductors with an insulation rating of 300V minimum, rated for 221° F (105° C), a minimum flammability rating of VW-1, and be of appropriate gauge for the voltage and current required (see specifications).
- Do not allow moisture to enter the electronics enclosure. Conduit should slope downward from the unit housing. Install drip loops and seal conduit with silicone rubber product.

DISCONNECT REQUIREMENTS FOR PERMANENTLY INSTALLED EQUIPMENT

A dedicated disconnecting device (circuit breaker) must be provided for the proper installation of the unit. If independent circuits are used for power input and outputs, individual disconnects are required.

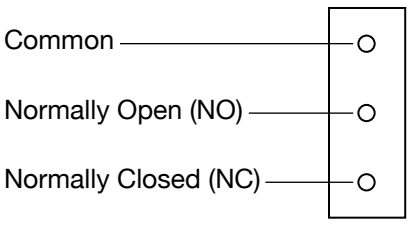
Disconnects must meet the following requirements:

- Located in close proximity to the device
- Easily accessible to the operator
- Appropriately marked as the disconnect for the device and associated circuit
- Sized appropriately to the requirements of the protected circuit (See specifications)

PROTECTIVE EARTH GROUND

To eliminate shock hazards in the unlikely event of an internal insulation breakdown, the unit is provided with a "protective earth" (⏚) lead which must be connected to earth ground. In addition, the input power ground lead must be connected to the "protective earth" (⏚) terminal provided. Wire sizes must be selected such that it can safely carry the sum total of all circuits' maximum amperage.

WIRING



VI. MAINTENANCE

PREVENTIVE MAINTENANCE

Semi-annual or annual inspection of the diaphragm, vent and switch circuit is recommended.

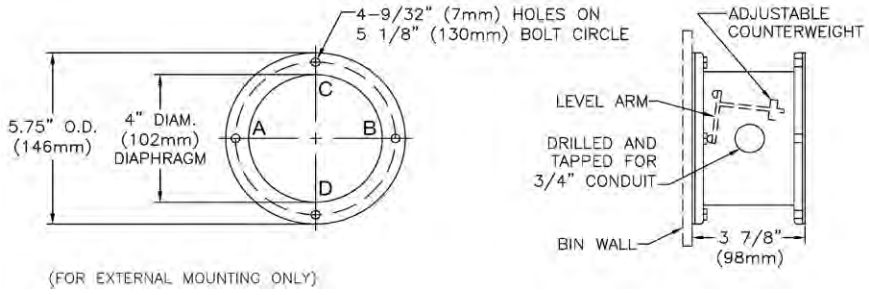
RECOMMENDED SPARE PARTS

BANTAM BIN-DICATOR		
LAB110700	A-BB-3	Lever Arm Assembly
LAB121360	BB-2	Cover
LAB121410	BB-6	Aluminum Diaphragm Retaining Washer
LAB121420	BB-6A	Stainless Steel Diaphragm Retaining Washer
LAB121430	BB-9	Neoprene Diaphragm
LAB121510	BB-9H	Teflon®-Coated Neoprene Diaphragm
LAB121530	BB-15	Diaphragm Back Plate
LAB121580	BB-5	Brass Pivot Rod
LAB122138	BB-3	Brass Lever Arm
LAB130940	BB-7	Rubber Mounting Gasket
LAB130950	BB-7A	Rubber Cover Gasket
LAB130960	BB-8	Counterweight Segment, Lead, 1 oz
LAB130970		Micro Switch, 185° F (85° C), Marked BA-2RV-191-A2
LAB130980		Micro Switch, 250° F (121° C)
AUTO-BIN-DICATOR		
LAD110750	A-D-8A	Switch Assembly w/ Bracket, Cam, and Barriers; 185° F (85 C)
LAD110751	A-D-8B	Switch Assembly w/ Bracket, Cam, and Barriers; 250 F (121 C)
LAD110752	A-D-8C	00 Switch Assembly w/ Bracket, Cam, and Barriers; 800 F (427 C)
LAD121590	AB-4	Diaphragm Back Plate
LAD121600	AB-5	Aluminum Diaphragm Retaining Washer
LAD121610	AB-6	Stainless Steel Diaphragm
LAD121620	AB-6A	Neoprene Diaphragm
LAD122004	AB-5SS	Stainless Steel Diaphragm Retaining Washer
LAD131030	AB-8	Perimeter Springs (Behind Diaphragm Back Plate)
LAD131040	D-8A	Micro Switch Marked BA-2RB35-A2, 185° F (85° C)
LAD131050	D-8B	Micro Switch, 250° F (121° C)
LAD131060	D-8C	Micro Switch, 800° F (427° C)
LAD131090	AB-10	Mounting Gasket
LAG110800	G-6E	Cam Assembly
LAG121700	G-3	Cover
LAG121760	G-7A	Push Rod

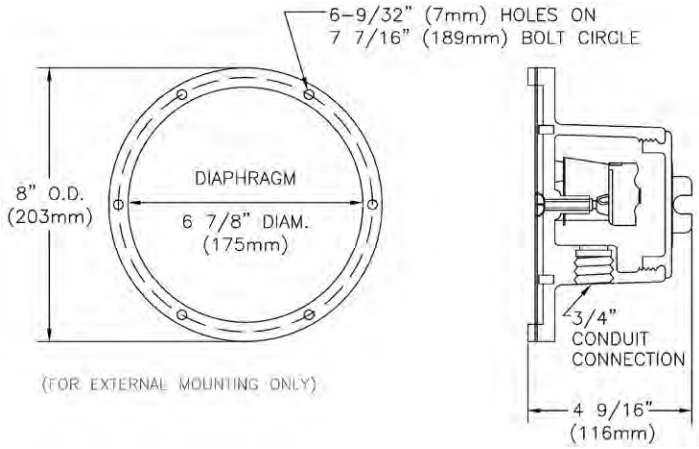
MODEL A		
LAA110550	A-115-A	Canvas Diaphragm Assembly
LAA110560	A-11	Fiberglass Diaphragm Assembly, 0.010 in. (0.254 mm)
LAA110570	A-115-C	Light Neoprene Diaphragm Assembly, 0.013 in. (0.330 mm)
LAA110580	A-115-D	Medium Neoprene Diaphragm Assembly, 0.025 in. (0.635 mm)
LAA110590	A-115-E	Heavy Neoprene Diaphragm Assembly
LAA110610	A-115-G	Heavy Silicone Diaphragm Assembly
LAA110630	A-115-J	Heavy Teflon®-Coated Fiberglass Diaphragm Assembly
LAA110670	A-AA18	(2) 119-A Switches Mounted in Brackets
LAA110790	A-116A	Mercury Switch (G-10Z) and Mounting Clip
LAA120980	AA-5A	Lever Plate (Micro/Mercury Switch)
LAA120990	AA-5B	Lever Plate (Micro Switch) Model, Underslope Mounting
LAA121010	AA-9A	Cover for Explosionproof Model A Bin-Dicator
LAA121040	AA-10	Steel Diaphragm Retaining Washer
LAA121050	AA-10A	Stainless Steel Diaphragm Retaining Washer
LAA121090	AA-13B	Single/Double Micro Switch Bracket, Aluminum (2 Required)
LAA121110	AA-13D	High Temperature Micro Switch Bracket (1 Required)
LAA121130	AA-14	Steel Diaphragm Back Plate
LAA122120	AA-2	Brass Pivot Rod
LAA122121	AA-3	Brass Diaphragm Push Rod
LAA130591	AA-9	General Purpose Cover, Plastic, Model A
LAA130592		General Purpose Cover, Minlon®, Model A
LAA130730	AA-7	Counterweight Segment, Lead, 1 oz
LAA130770	AA-11	Cover Mounting Gasket
LAA130780	AA-11	Klinger Mounting Gasket for High Temperature Switch
LAA130800	117	Mercury Switch (G-10Z) Mounting Clip
LAA130810	118	2-Pole Terminal Block
LAA130820	119-A	Micro Switch, 185° F (85° C)
LAA130830	119-B	Micro Switch, 250° F (121° C)
LAA130840	119-C	00 Micro Switch, 800° F (427° C)
LAA130850	122-A	0 EX-AR Explosionproof Micro Switch, SP/DT, 185° F (85° C)
LAA130860	122-B	0 EX-DAR Explosionproof Micro Switch, DP/DT, 185° F (85° C)
LUA030820	4107	Brass External Cap Nut for AA-3 Brass Rod
LUA030830	4107A	Stainless Steel External Cap Nut for AA-3 Brass Rod

VI. DIMENSIONAL DRAWINGS

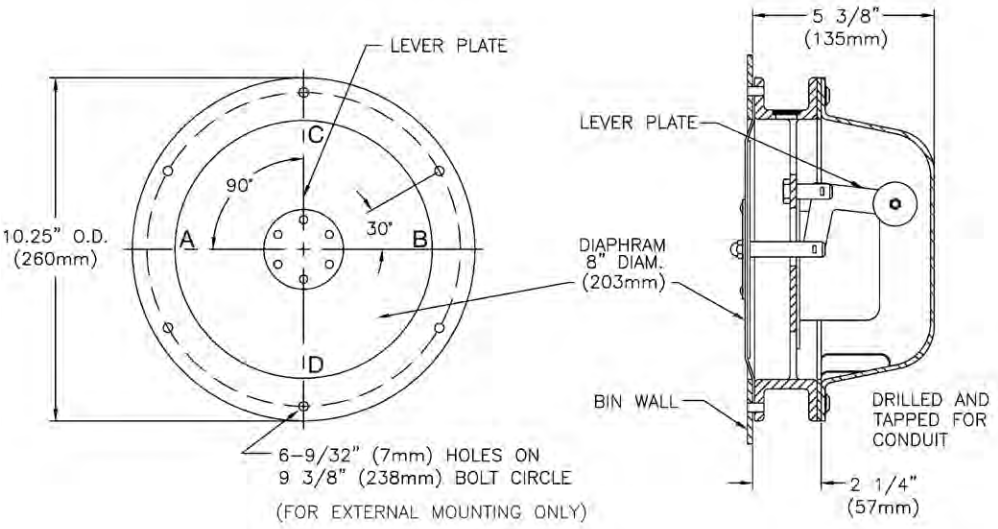
Bantam Bin-Dicator



Auto-Bin-Dicator



Model 'A'



BALDOR • RELIANCE

Integral Horsepower
AC Induction Motors
ODP, WPI Enclosures
TENV, TEAO, TEFC Enclosure
Explosion Proof

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Section 1

General Information

Overview

This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- IEC 34–1 Electrical and IEC72–1 Mechanical specifications
- ANSI C51.5, the National Electrical Code (NEC) and local codes and practices.

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: **This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment. Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

Continued on next page.

Safety Notice Continued

WARNING: **Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20 º angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the "shell".

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: Rm = kV + 1

where: (Rm is minimum resistance to ground in Meg–Ohms and kV is rated nameplate voltage defined as Kilo–Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg–ohms (use 5 M Ω).

For a 4160VAC rated motor Rm = 5.16 meg–ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10 ºC (50 ºF) to 49 ºC (120 ºF) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

Note: Remove motor from containers when heaters are energized, reprotect if necessary.

3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re–seal by taping it closed.
   c. If a zipper–closing type bag is used instead of the heat–sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.
5. Motors with anti–friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked "Do Not Lubricate" on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti–friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. "Provisions for oil mist lubrication" – These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. "Oil Mist Lubricated" – These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under "Standard Condition" in Section 3, then rotate the shaft 15 times by hand.

6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material.
   An acceptable product for this purpose is Exxon Rust Ban # 392.
8. Carbon brushes should be lifted and held in place in the holders, above the commutator, by the brush holder fingers. The commutator should be wrapped with a suitable material such as cardboard paper as a mechanical protection against damage.

Non–Regreaseable Motors

Non–regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

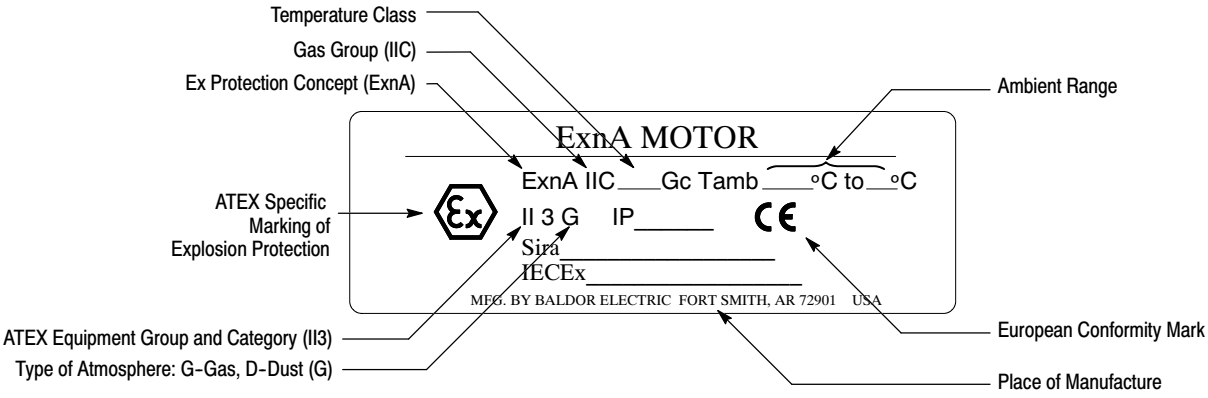
Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Equipment Marking for IEC Certified Product

IEC certified products have special markings that identify the protection concept and environment requirements. An example is shown in Figure 1-1.

Figure 1-1 IEC Certified Product Markings



Specific Conditions of Use:

If the motor certificate number is followed by the symbol "X", this indicates that the motor has specific conditions of use which are indicated on the certificate. It is necessary to review the product certification certificate in conjunction with this instruction manual.

Operation On Frequency Converters:

If the motor is evaluated for operation with an adjustable speed drive, the type of converter (for example PWM for Pulse Width Modulated) and safe speed ranges (for example 0- 120Hz) will be specified in the certification documents or on motor nameplates. It is necessary to consult the adjustable speed drive

manual for proper set up. IECEx Certificates are available online at www.iecex.com

Unit Conversions	
Inches to Millimeters	Inches x 25.4 = mm
Millimeters to Inches	mm x .03937 = Inches
Horsepower to Kilowatts	Hp x .746 = Kw
Kilowatts to Horsepower	Kw x 1.341 = Hp
Pounds to Kilograms	Lbs x .454 = Kg
Kilograms to Pounds	Kg x 2.205 = Lbs

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use. When used with converters, please consult converter manufacturers literature regarding recommendations on cable types, cable shielding, cable shielding termination, connection recommendations and any filters which may be recommended for EMC compliance. For additional information, consult Baldor MN1383.

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip–Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non–corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service. IEEE841 motors are suitable for application in Class I Division 2 and Class I Zone 2 areas on sine wave power in accordance with the applicable codes and standards.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

EMC Compliance Statement for European Union

The motors described in this instruction manual are designed to comply 2004/108/EC . These motors are commercial in design and not intended for residential use.

Mounting Location

The motor should be installed in a location compatible with the motor enclosure and specific ambient. To allow adequate air flow, the following clearances must be maintained between the motor and any obstruction:

Table 2-1 Enclosure Clearance

TEFC / TENV (IC0141) Enclosures	
Fan Cover Air Intake	180 – 210T Frame 1” (25mm)
Fan Cover Air Intake	250 – 449T Frame 4” (100mm)
	IEC 112 – 132 1” (25mm)
	IEC 160 – 280 4” (100mm)
Exhaust	Envelope equal to the P Dimension on the motor dimension sheet
OPEN/Protected Enclosures	
Bracket Intake	Same as TEFC
Frame Exhaust	Exhaust out the sides envelope A minimum of the P dimension plus 2” (50mm) Exhaust out the end same as intake.

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

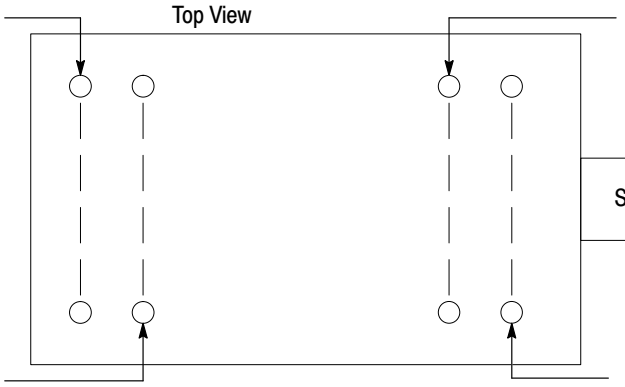
When installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Frame Mounting Holes

Some motors have standardized frames containing 6 or 8 mounting holes. 6 hole frames are not suitable for field reversal of mounting from F–1 to F–2, etc. Figure 2-1 indicates the proper mounting holes to use.

Figure 2-1 6 & 8 Hole Motor Frame Mounting



For short frame designations 182, 213, 254, 284, 324, 364, 404, 444 (NEMA)

Allows F-1 to F-2 Conversion on 8 hole frames.
Not present on 6 hole frames.
Not used on 8 hole frames.

For long frame designations 184, 215, 256, 286, 326, 365, 405, 445 (NEMA) (IEC) 112M, 132M, 160L, 200L, 225M, 250M, 280M

Always use these holes, closer to the shaft 112S, 132S, 160M, 180M, 200M, 225S, 250S, 280S, (IEC)

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

In the case of assemblies on a common base, any lifting means provided on the motor should not be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. Assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. Direct Coupling
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. End-Play Adjustment
   The axial position of the motor frame with respect to its load is also extremely important. The standard motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. Pulley Ratio
   The best practice is to not exceed an 8:1 pulley ratio.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. Belt Drive
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor•Reliance motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment.

Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure.

Flanged nuts or bolts may be used as an alternative to washers.

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Guarding

Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ExnA hazardous location motors, it is a specific condition of use that all terminations in a conduit box be fully insulated. Fully insulated and lugged terminations must be bolted and provided with lock washer to prevent rotation. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Grounding

In the USA consult the National Electrical Code, Article 430 for information on grounding of motors and generators, and Article 250 for general information on grounding. In making the ground connection, the installer should make certain that there is a solid and permanent metallic connection between the ground point, the motor or generator terminal housing, and the motor or generator frame. In non–USA locations consult the appropriate national or local code applicable.

Motors with resilient cushion rings usually must be provided with a bonding conductor across the resilient member. Some motors are supplied with the bonding conductor on the concealed side of the cushion ring to protect the bond from damage. Motors with bonded cushion rings should usually be grounded at the time of installation in accordance with the above recommendations for making ground connections. When motors with bonded cushion rings are used in multimotor installations employing group fusing or group protection, the bonding of the cushion ring should be checked to determine that it is adequate for the rating of the branch circuit over current protective device being used.

There are applications where grounding the exterior parts of a motor or generator may result in greater hazard by increasing the possibility of a person in the area simultaneously contacting ground and some other nearby live electrical parts of other ungrounded electrical equipment. In portable equipment it is difficult to be sure that a positive ground connection is maintained as the equipment is moved, and providing a grounding conductor may lead to a false sense of security.

Select a motor starter and over current protection suitable for this motor and its application. Consult motor starter application data as well as the National Electric Code and/or other applicable local codes.

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Crosssectional area of phase conductors, S	Minimum crosssectional area of the corresponding protective conductor, S_p
mm^2	mm^2
$S < 16$	S
$16 < S \leq 35$	16
$S > 35$	$0{,}5\ S$

Equipotential bonding connection shall made using a conductor with a cross-sectional area of at least 4 mm^2.

Conduit Box

For ease of making connections, an oversize conduit box is provided. Most conduit boxes can be rotated 360 ° in 90 ° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power

Motors with flying lead construction must be properly terminated and insulated.

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).

OR

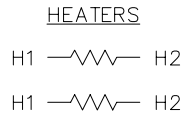
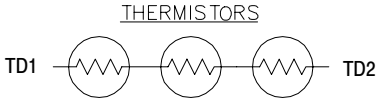
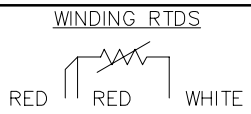
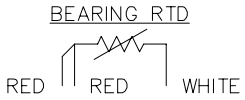
2. AC power is within ±5% of rated frequency with rated voltage.

OR

3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-3.

Figure 2-2 Accessory Connections

	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
	Three thermistors are installed in windings and tied in series. Leads are labeled TD1 & TD2.
	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled 1TD1, 1TD2, 1TD3, 2TD1, 2TD2, 2TD3 etc.
	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Rotation

All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn–to–turn, phase–to–phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

Note: Main power leads for CE Marked Motors may be marked U,V,W – for standard configurations, please consult connection diagrams.

Caution: **The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a division 2 or zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

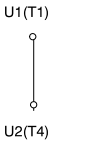
AC Motor Connection Diagram

IEC VERSUS NEMA LEAD MARKING

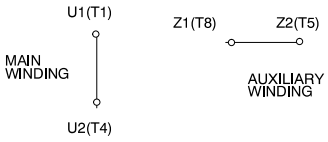
EXAMPLE COMPARISIONS OF IEC AND NEMA LEADING MARKINGS FOR COMMON CONNECTION TYPES ARE SHOWN BELOW.

SINGLE PHASE MOTORS

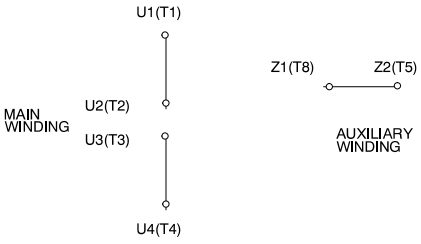
SINGLE VOLTAGE NON REVERSIBLE



SINGLE VOLTAGE REVERSIBLE



DUAL VOLTAGE REVERSIBLE



AC Motor Connection Diagram

THREE PHASE

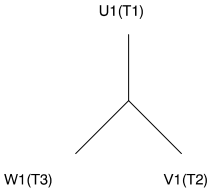
FOR SINGLE WINDING 3 PHASE MOTORS, LEAD MARKINGS CAN BE DIRECTLY TRANSLATED BETWEEN IEC AND NEMA DESIGNATIONS. FOR THESE MOTORS, THE LEAD MARKINGS ARE EQUIVALENT AS FOLLOWS:

U1=T1	U2=T4	U5=T7	U6=T10
V1=T2	V2=T5	V5=T8	V6=T11
W1=T3	W2=T6	W5=T9	W6=T12

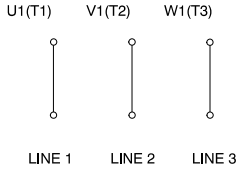
EXAMPLES OF COMMON CONNECTIONS ARE GIVEN BELOW.

THREE LEADS

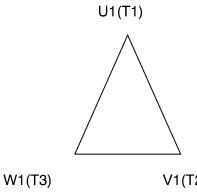
WYE CONNECT



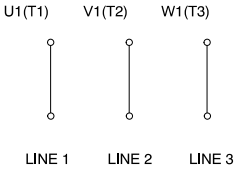
WIRING DIAGRAM



DELTA CONNECT



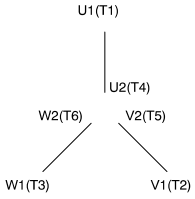
WIRING DIAGRAM



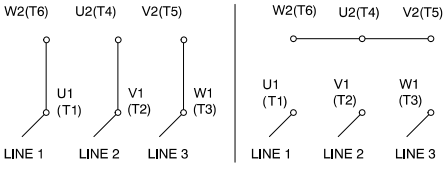
AC Motor Connection Diagram

SIX LEADS

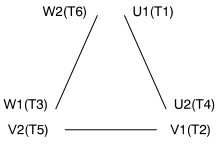
DELTA-WYE CONNECT



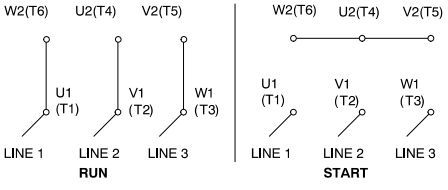
DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 1.73:1



WYE-DELTA CONNECT



WYE START-DELTA RUN SINGLE VOLTAGE

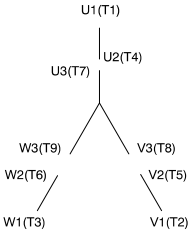


AC Motor Connection Diagram

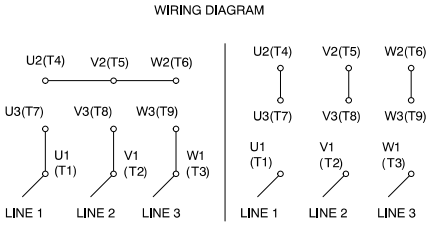
NINE LEADS

DUAL VOLTAGE-HIGH TO LOW VOLTAGE RATIO 2:1

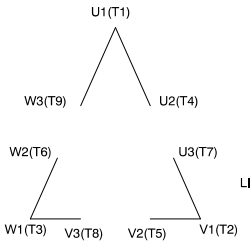
WYE CONNECT



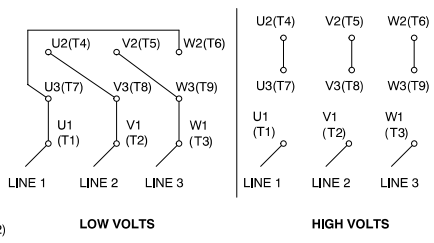
WIRING DIAGRAM



DELTA CONNECT



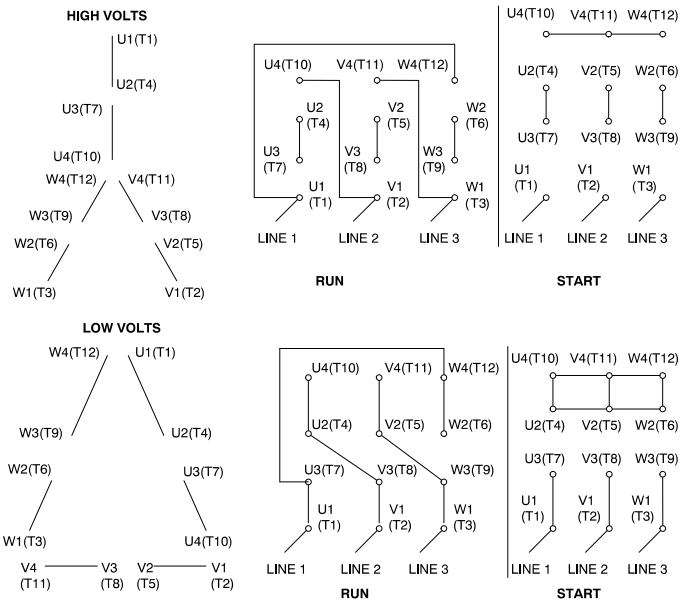
WIRING DIAGRAM



AC Motor Connection Diagram

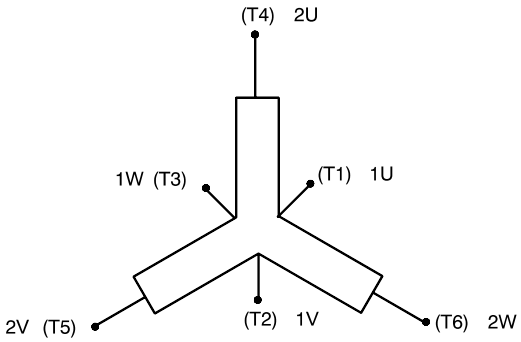
TWELVE LEADS

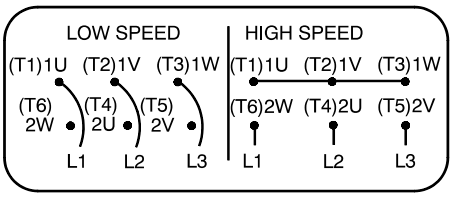
DUAL VOLTAGE WYE START – DELTA – RUN



AC Motor Connection Diagram

SINGLE WINDING MULTI-SPEEDS CONSTANT TORQUE

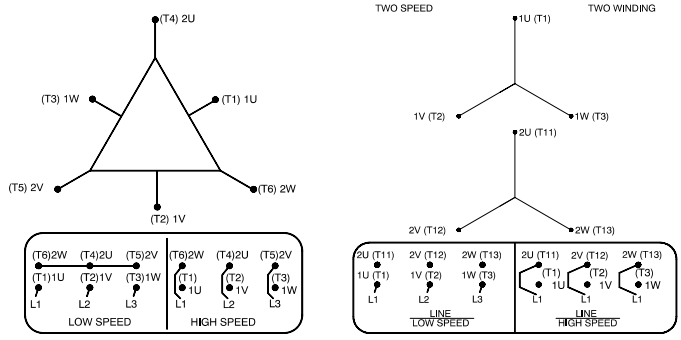




(N.P. 1634–DE)

AC Motor Connection Diagram

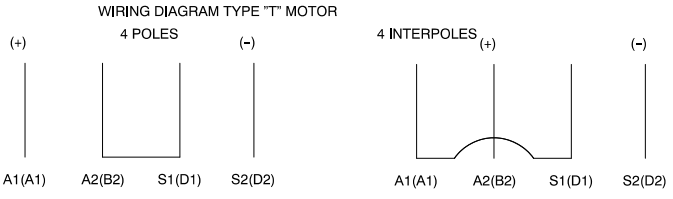
SINGLE WINDING MULTI-SPEEDS CONSTANT HP.



TWO SPEED TWO WINDING

DC Motor Connection Diagram

WIRING DIAGRAM TYPE "T" MOTOR



ROTATION – FACING COMMUTATOR END

COMPARISON OF IEC AND NEMA LEAD MARKINGS
FOR DIRECT CURRENT MOTORS

A1--A1
A2--B2
S1--D1

S2--D2

MOTOR WINDING THERMOSTATS

CONTACTS _____ @ _____ °C
FIGURE NUMBER _____

CONTACT RATING

VOLTS	CONTINUOUS AMPERES	INRUSH AMPERES
110 - 120	3.0	30
220 - 240	1.5	15
440 - 480	0.75	7.5
550 - 600	0.60	6.0

THERMOSTATS

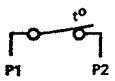
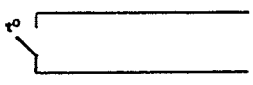
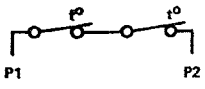
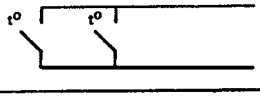
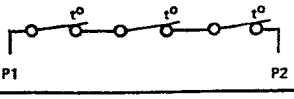
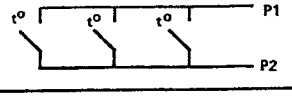
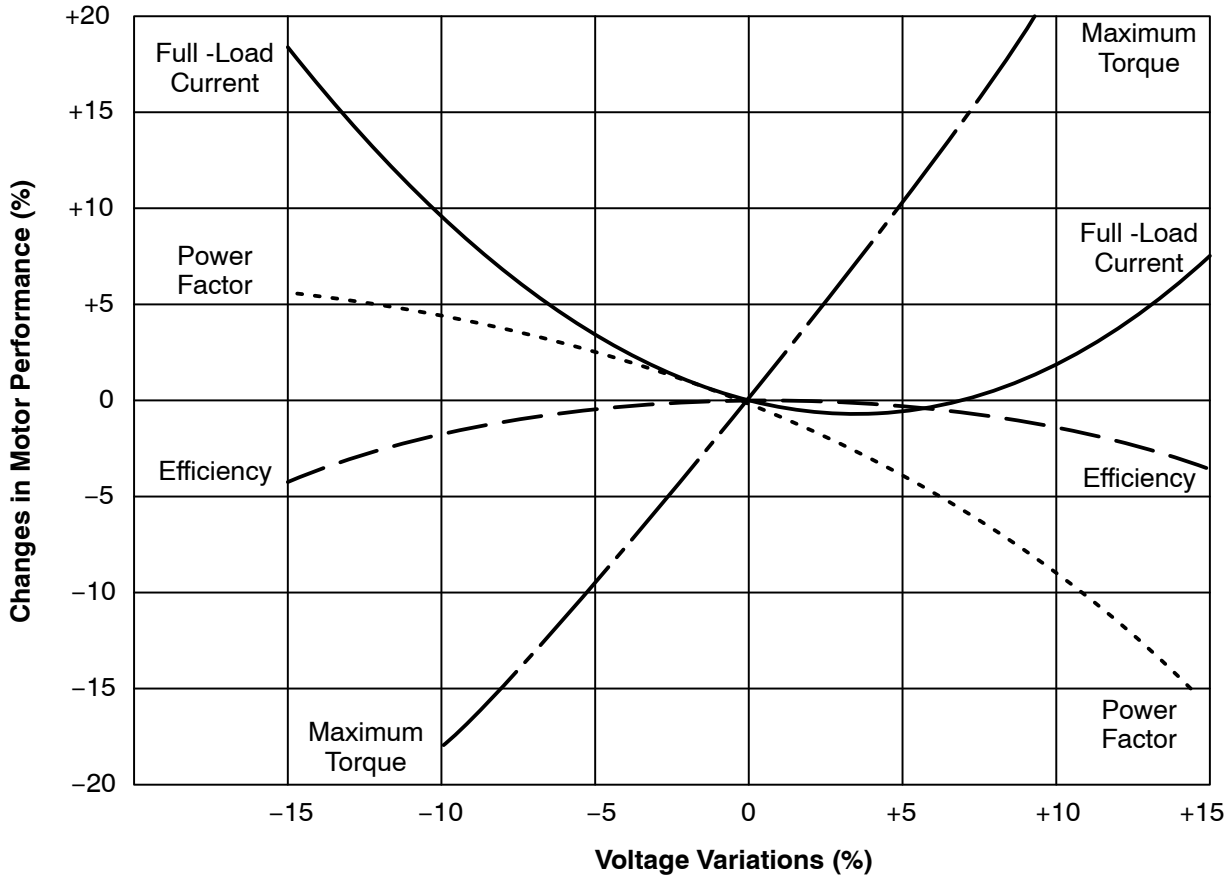
NORMALLY CLOSED	NORMALLY OPEN
FIGURE 1 	FIGURE 4 
FIGURE 2 	FIGURE 5 
FIGURE 3 	FIGURE 6 

Figure 2-3 Typical Motor Performance VS Voltage Variations



Initial Lubrication

Baldor•Reliance motors are shipped from the factory with the bearings properly packed with grease and ready to operate. Where the unit has been subjected to extended storage (6 months or more) the bearings should be relubricated (regreasable type) prior to starting. When motors are equipped for oil mist lubrication refer to the instruction manual for installation, operation, and maintenance of oil mist lubrication systems.

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Section 3.**

First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.

10. After 1 hour of operation, disconnect power and connect the load to the motor shaft.
    Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.
11. If motor is totally enclosed fan–cooled or non–ventilated it is recommended that condensation drain plugs, if present, be removed. These are located in the lower portion of the end–shields. Totally enclosed fan–cooled “XT” motors are normally equipped with automatic drains which may be left in place as received.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation.
   Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Hazardous Locations

Hazardous locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers or flyings.

Selection

Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code. In international hazardous location areas, guidance for gas / vapor / mist classification is given in IEC60079–14, or for dust in IEC61241–14. This classification process lets the installer know what equipment is suitable for installation in that environment, and identifies what the maximum safe temperature or temperature class is required. It is the customer or users responsibility to determine the area classification and select proper equipment.

Areas are classified with respect to risk and exposure to the hazard. In the US market, areas are typically classified as follows Class, Division, Group and Temperature Class. In some newer installations in the US and in most international markets, areas are classified in Zones.

Protection Concepts

Class I Division 1 / Zone 1 [Equipment Group I (mining) or II (surface), Equipment Protection Level (EPL) Gb, Mb]

Baldor offers a range of motors suitable for installation in a Division 1 or Zone 1 environment. These motors are known as explosion proof or flameproof.
Motors that are explosion proof or flameproof use specially machined flameproof joints between the end bell or bracket and the frame, as well as along the rotating shaft and at connection box covers and entries. The fit of these flameproof joints are designed to contain the combustion or quench the flame of an explosive gas atmosphere prior to it exiting the motor. These flameproof joints have lengths and widths selected and tested based on the gas group present in the atmosphere. Baldor•Reliance motors are typically designed to meet Class I (Division 1) Group C and D (explosion proof) or Ex d IIB (flameproof).

An application note regarding equipment applied in accordance with the US National Electric Code (NFPA 70–2008) – according to Article 500.8(C) Marking, sub clause (2) in the fine print note, it is noted that Equipment not marked to indicate a division is suitable for both Division 1 and Division 2 locations. These motors are not gas tight. To the contrary, this protection concept assumes that due to the normal heating and cooling cycle of motor operation that any gas present will be drawn into the motor. Since flameproof or explosion proof motors are designed to contain the combustion and extinguish any flame transmission, for this protection concept, only external surface temperatures are of concern. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions.

If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device. The ATEX directive requires that motor shutdown on thermal trip be accomplished without an intermediate software command. Where intermediate circuitry is involved the circuit shall fall within the scope of a safety, controlling and regulating device as defined in article 1(2) of European Directive 94/9/EC, and shall be covered by an appropriate EC Type Examination Certificate.

Flameproof motors, internationally referred to as Ex d use a protection concept similar to that used in Class I Division 1 motors, with minor differences in the flameproof joints and cable entry designs. Flameproof and explosion proof motors are both type tested. Representative motors are connected to a reference gas and ignited in laboratory conditions to verify that the flame is not transmitted outside the motor enclosure and to determine the maximum internal pressure encountered.

Explosion proof and Flame proof motors shipped without a conduit box require use of a certified box of suitable dimensions and that is appropriate for the classification. Openings in connection boxes must be closed with suitably certified and dimensioned device.

Class I Division 2 / Zone 2 Ex nA, [Equipment Protection Level (EPL) Gc]

This protection concept relies on having no sources of ignition present such as arcing parts or hot surfaces. For this protection concept, internal temperatures as well as external temperatures are considered. In many cases, the internal temperatures are higher than the external temperatures and therefore become the limiting factor in determination of temperature code designation. In these applications, it is very important to use a motor that has been evaluated thermally for use with an inverter or converter, if variable speed operation is desired. Thermostats used for Class I Division 2 and Ex nA motors are used to protect the motor only. For motors using flying lead construction, it is important to use connection lugs and insulate with heat shrink tubing or a double wrap of insulation grade electrical tape to avoid the risk of spark or ignition.

Class II Division 1 / Zone 21 [Equipment Group III, Equipment Protection Level (EPL) Db]

This area classification is one where the risk of ignitable concentrations of dust is present at all or some of the time. The protection concepts used for Class II Division 1 is similar to flamepath, except with additional dust exclusion paths designed for the rotating shaft. In the international designations, this concept is referred to as dust ignition proof or Ex tD. External surface temperature remains the limiting factor. Thermal limiting devices such as thermostats, thermistors or RTDs may be provided on these motors to limit the external surface temperature during overload conditions. If thermostats are provided as a condition of certification, it is the installer's responsibility to make sure that these devices are properly connected to a suitable switching device.

Note: In the North American area classification system, Class III exists for fibers and flyings.
In the IEC designation, both dusts and flyings are absorbed into Group III.

Class II Division 2 / Zone 22 [Equipment Group III, Equipment Protection Level (EPL) Dc]

This area classification is one where the risk of exposure to ignitable concentrations of dust are not likely to occur under normal operating conditions and relies heavily on the housekeeping practices within the installation.

Sine Wave Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22 Hazardous Location.

These motors are designed to operate at or below the maximum surface temperature (or T–Code) stated on the nameplate. Failure to operate the motor properly can cause this maximum surface temperature to be exceeded. If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperatures above nameplate value
3. Voltages above or below nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Altitude above 3300 feet / 1000 meters
7. Severe duty cycles of repeated starts
8. Motor stall
9. Motor reversing
10. Single phase operation of polyphase equipment
11. Variable frequency operation

Variable Frequency Power Operation for Division 1 or 2 and Zone 1 or 2 and Zone 21 or 22

Hazardous Location (motors with maximum surface temperature listed on the nameplate).
Only motors with nameplates marked for use on inverter (variable frequency) power, and labeled for specific hazardous areas may be used in those hazardous areas on inverter power. The motor is designed to operate at or below the maximum surface temperature (or T–Code) stated on the nameplate.
Failure to operate the motor properly can cause this maximum surface temperature to be exceeded.

If applied in a Division 1 or 2 / Zone 1 or 2 and Zone 21 or 22 environment, this excessive temperature may cause ignition of hazardous materials. Operating the motor at any of the following conditions can cause the marked surface temperature to be exceeded.

1. Motor load exceeding service factor nameplate value
2. Ambient temperature above nameplate value
3. Voltage (at each operating frequency) above or below rated nameplate value
4. Unbalanced voltages
5. Loss of proper ventilation
6. Operation outside of the nameplate speed / frequency range
7. Altitudes above 3300 feet / 1000 meters
8. Single phase operation of polyphase equipment
9. Unstable current wave forms
10. Lower than name plate minimum carrier frequency

Thermal Limiting
Thermal limiting devices are temperature sensing control components installed inside the motor to limit the internal temperature of the motor frame by interrupting the circuit of the holding coil of the magnetic switch or contactor. They are required for most Division 1 and Zone 1 applications. For Division 2 or Zone 2 applications, motors should be selected that preclude running temperatures from exceeding the ignition temperatures for the designated hazardous material. In Division 2 or Zone 2 classified locations, thermal limiting devices should only be used for winding protection and not considered for limiting all internal motor temperatures to specific ignition temperatures.

Equipotential Bonding and Shaft Current Reduction
Larger motors (ie WP construction) may require proper bonding between motor enclosures and covers to avoid the risk of stray currents during start up. Fastening methods and bonding straps must not be modified. Bearing currents can exist in some motors for both line–fed and inverter–fed applications. Larger line–fed motors may require at least one insulated bearing to prevent a flow of current through the bearings. Do not defeat such insulation whether the motor is line–fed or inverter–fed applications. Inverter–fed motors may require additional bearing insulation or even a shaft brush. Do not defeat such features. When the motor and the coupled load are not on a common conductive baseplate, it may also be necessary to electrically bond together the stationary parts of the motor and the coupled equipment.

Repair of Motors used in Hazardous Locations

Repair of hazardous certified motors requires additional information, skill, and care. It is the customer's responsibility to select service shops with proper qualifications to repair hazardous location motors. Contact the manufacture for additional repair details. Use only original manufacturer's parts.

Repair of Explosion Proof or Flame Proof Motors Class I Division 1 and Zone 1

In the North American market, recertification programs are offered by Underwriters Laboratories and Canadian Standards Association which allow authorized service shops to mark the rebuilt motors as certified. In the international markets using IEC based requirements, repair should be undertaken only after consulting IEC60079–19 Explosive Atmospheres–Part 19 Equipment repair, overhaul and reclamation. If use of a certified repair facility is desired, consult the IECEX Repair Scheme at http://www.iecex.com/service_facilities.htm

Explosion proof and flameproof motors achieve their safety based on the mechanical construction – flameproof joints and bearing clearance, and the electrical design including any thermal limiting devices. If it is necessary to repair a flameproof or explosion proof motor, it is critical that the mechanical flameproof joints be maintained. Consult Baldor Electric Company for flameproof joint construction details.
Use only Baldor•Reliance supplied parts. Baldor does not recommend reclamation of parts.
Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present.

Repair of Dust Ignition Proof Motors – Class II Division 1 and 2, Zone 21 and 22.

For Dust Ignition Proof, proper sealing is required. Do not modify the motor construction to add any additional opening, and ensure that proper sealing is maintained in the connection box and at the shaft seal. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present

Repair of Class I Division 2 and Zone 2 motors

For Division 2 and Zone 2, the internal and external temperatures are of concern. Since this protection method also relies on temperature being maintained, make sure that any rewinding uses the original electrical designs, including any thermal protection that may be present. Use only Baldor replacement thermostats, if provided.

Section 3

Maintenance & Troubleshooting

WARNING: UL and EX Listed motors must only be serviced by UL or EX Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Perform a dielectric with stand test periodically to ensure that the integrity of the winding insulation has been maintained. Record the readings. Immediately investigate any significant decrease in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil) or as stated on the nameplate.
Do not mix greases unless compatibility has been checked and verified.

Ball Bearing Motors

Operating Temperature –25 ºC (–15 ºF) to 50 ºC (120 ºF)

EXXON	POLYREX EM (Standard on Baldor motors)
EXXON	UNIREX N2
EXXON	BEACON 325
CHEVRON OIL	SRI NO. 2 (Compatible with Polyrex EM)
CHEVRON OIL	BLACK PEARL
TEXACO, INC.	PREMIUM RB
TEXACO, INC.	POLYSTAR
AMOCO	RYKON # 2
PENNZOIL	PENNZLUBE EM–2
DARMEX	DARMEX 707
DARMEX	DARMEX 711
PETRO–CANADA	PEERLESS LLG
SHELL OIL	DOLIUM BRB

Minimum Starting Temperature –60 ºC (–76 ºF)

SHELL OIL CO.	AEROSHELL 7 (Standard on Baldor motors)
MOBIL	MOBIL 28
MOBIL	MOBILITH SHC 100 (Low Temperature – Arctic Duty)

Roller Bearing Motors

Operating Temperature –25 ºC (–15 ºF) to 50 ºC (120 ºF)

TEXACO, INC.	PREMIUM RB
MOBIL	MOBILITH SHC 220 (Standard on Baldor motors)
CHEVRON OIL	BLACK PEARL

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-2 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	**6000**	**3600**	**1800**	**1200**	**900**
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 449 incl. (315)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40 ºC	Clean, Little Corrosion
Severe	16 Plus	50 ºC	Moderate dirt, Corrosion
Extreme	16 Plus	>50 ºC* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29 ºC **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6318	1.52(40)	2.5	8.2
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–355)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–355)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: **To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.**

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: **Over–lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.**

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43 °C and the atmosphere is moderately corrosive.

1. Table 3-2 list 9500 hours for standard conditions.
2. Table 3-3 classifies severity of service as "Severe".
3. Table 3-5 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Shaker Duty Motors only

Caution: **Shaker Duty motors must be properly lubricated prior to Start Up to prevent damage. See Table 3-6.**

Lubrication should be performed before Start Up and at regular maintenance intervals. Follow these recommendations to ensure proper lubrication.

Recommended Lubricant

For ambient temperatures between –15 °F to 120 °F the following lubricants are recommended: Mobil PolyrexEM, Texaco Premium RB, Exxon Unirex N–2.

Do not mix greases unless compatibility has been checked and verified.

Table 3-5 Lubrication Volume

NEMA Frame Size	Volume in Cubic Inches					
	Normal Duty		Severe Duty		Extreme Duty	
	Start Up	Relub	Start Up	Relub	Start Up	Relub
184TY	1.4	0.5	1.4	0.5	2.7	0.5
215TY	1.6	0.5	1.6	0.5	4.5	1
256TY	7	1			11	2
286TY	9	1			15	3

Lubrication Frequency

Normal Duty 8 hours per day (16 hours per day in a clean environment). Lubricate every 2 months.

Severe Duty 16 hours per day or more in a dirty environment (corrosive atmosphere, chemical fumes, acids, alkalies or extreme high humidity). Lubricate every month or 700 hours of operation.

Extreme Duty operation in extremely dirty or dusty environments and high ambient temperatures exceeding 104 °F (40 °C). Lubricate twice a month or 350 hours of operation.

Lubrication Procedure

1. Locate the grease inlet and outlet. Clean the areas.
2. Remove the plug(s) and install a grease fitting in the inlet if grease fitting is not already installed.
3. Add the recommended amount of lubricant.
4. Run the motor for two hours with the outlet plug removed.
5. Install outlet plug.

Note: To loosen hardened grease it may be necessary to insert a rod or wire into the grease inlet and outlet holes.

Table 3-6 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage. Eccentric air gap.	Check input line connections. Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings. Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately 3/4 filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately 3/4 filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately 3/4 filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately 3/4 filled.

Suggested bearing and winding RTD setting guidelines for Non–Hazardous Locations ONLY

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80 ºC) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Table 3-7 Winding RTDs – Temperature Limit In ºC (40 ºC Maximum Ambient)

Motor Load (Typical Design)	Class B Temp Rise ≤ 80 ºC		Class F Temp Rise ≤ 105 ºC		Class H Temp Rise ≤ 125 ºC	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.

When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Table 3-8 Bearing RTDs – Temperature Limit In oC (40 ºC Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Notes: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants include the following:

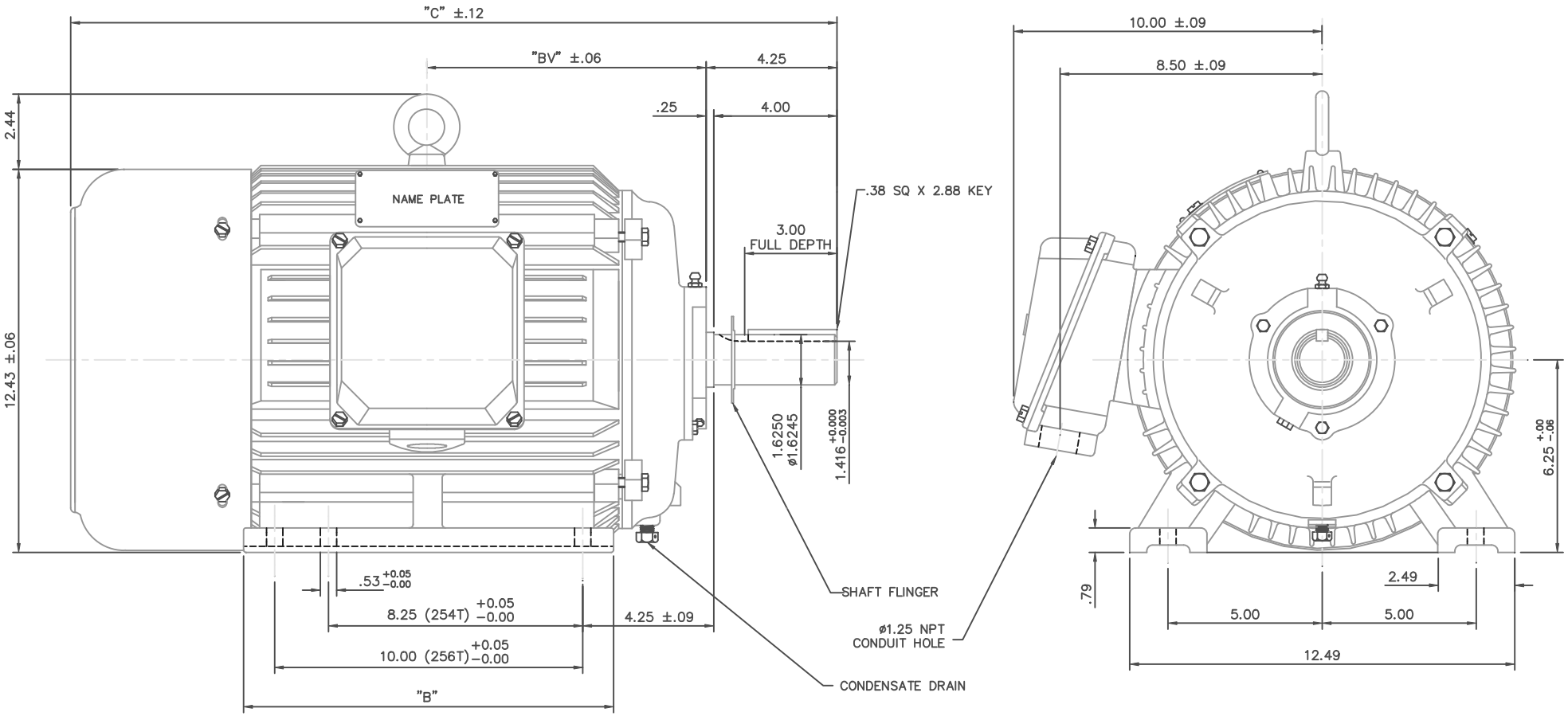
– Texaco Polystar – Rykon Premium #2 – Chevron SRI #2

– Mobilith SHC–100 – Pennzoil Pennzlube EM–2 – Chevron Black Pearl

– Darmex 707 – Darmex 711 – Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.



NOTE: 256T HAS 6 MTG. HOLES, USING BOTH 254T AND 256T "2F" LOCATIONS.

FRAME	"C"	"B"	"BV"
254T	23.19	10.25	8.19
256T	24.92	12.00	9.06

NO.	REVISION	BY & DATE	CH'K'D.
01	REDRAWN TO CURRENT CAD STANDARDS	CJK 8/3/01	

TOLERANCES UNLESS OTHERWISE SPECIFIED		
DEC.	INCHES	METRIC
.X	±.1	±2.5
.XX	±.03	±.76
.XXX	±.005	±.127
.XXXX	±.0005	±.0127
FRACTIONS	±1/64	
ANGLES	±1/2°	

LEESON ELECTRIC CORPORATION

DRAWN DRZ 05/22/01	TITLE: OUTLINE – 250 FRAME TEFC – RIGID, NEW CON-BOX
APPR.	
R.F.P.	MAT'L.: CAST IRON
SCALE 5=16	
REF.	FINISH
FMF	REV. 01
	DRAWING NO. 169538-60

LEESON ELECTRIC MOTORS, GEARMOTORS AND DRIVES

Product Features

Catalog No	G151355.22	**Model**	C254T8FB5A A
Product type	AC MOTOR	**Stock**	Stock
Description	..5HP..900.254T.TEFC.230/460V.3PH.60HZ.CONT.40C..RIGID.....		

Information shown is for current motor's design

Engineering Data

Volts	208-230	Volts	460	Volts	
F.L. Amps	15.9-14.4	F.L. Amps	7.2	F.L. Amps	
S. F Amps	16.2	S. F Amps	8.1	S. F Amps	
RPM	900	Hertz	60		
HP	5	Duty	CONTINUOUS	TYPE	TF
KW	3.7				
Frame	254T	Serv. Factor	1.15	Phase	3
Max Amb	40	Design	B	Code	J
Insul Class	F	Protection	NOT	Therm.Prot.	
Eff 100%	88.3	Eff 75%		PF	70
UL	Y-(LEESON UL REC)	CSA	Yes	Bearing OPE	6308
CC Number	CC005A	CE	Yes	Bearing PE	6309
Load Type		Inverter Type		Speed Range	NONE
Motor Wt.	188 LB	Enclosure	TEFC	Lubrication	POLYREX EM
Nameplate	080307	Mounting	RIGID	Rotation	REV
Assembly		Shaft Dia.		Ext. Diag.	004172.01
Cust Part No		Outline	16953860	Ext. Diag2	
Packaging	B			Winding	T12908001
Carton Label				GROUP:	3
Iris		Paint	STANDARD	Test Card	
Form Factor		RMS Amps		Const Torque Speed Range	
Torque		Peak			
AB Code		Peak@DegC			
Resistance					
Connection					
Rework Status		Rework TYPE			
Hazardous Loc	NONE			Brake Motors	
Explosion Proof		Temp Op Code		FORCE	
Class		GROUP:		VDC	
Class		GROUP:		ADC	
				Brake Coil OHMs @25 C	

Performance

Torque UOM	LB-FT	Inertia (WK²)	3.307 LB-FT^2	
Torque	30.5(Full Load)	100(Break Down)	63(Pull Up)	63.1(Locked Rotor)
CURRENT (amps)	7.2(Full Load)	0(Break Down)	0(Pull Up)	45(Locked Rotor)
Efficiency (%)	0(Full Load)	88.1(75% Load)	86.7(50% Load)	79.9(25% Load)
PowerFactor	(Full Load)	66.9(75% Load)	54.6(50% Load)	34.7(25% Load)

Load Curve Data @60 Hz, 460 Volts, 5 Horsepower

Load	Amps	KW	RPM	Torque	EFF	PF	Rise By Resis	Frame Rise
0.0	4.12	0.406	898	0.0	0.0	20.3	0.0	-
0.25	4.43	1.219	894	8.67	79.9	34.7	0.0	-
0.5	5.1	2.256	888	16.57	86.7	54.6	0.0	-
0.75	6.0	3.24	881	23.98	88.1	66.9	0.0	-
1.0	7.18	4.261	873	31.39	88.3	70.0	29.1	-
1.25	8.58	5.401	866	39.57	88.1	79.0	0.0	-
1.5	10.1	6.53	857	47.5	86.8	81.0	0.0	-

SOURCE: CALCULATED **GROUP:** 3

NOTE #1: CAUTION: IT IS THE PURCHASERS OR USERS RESPONSIBILITY TO GUARD ALL SHAFTING IN ACCORDANCE WITH OSHA REQUIREMENTS.

NOTE #2: AI ASSEMBLY USE LOCTITE #242 ON 2 BOLTS AS SHOWN ON WORM BORES, BOTH ENDS OF HOUSING.

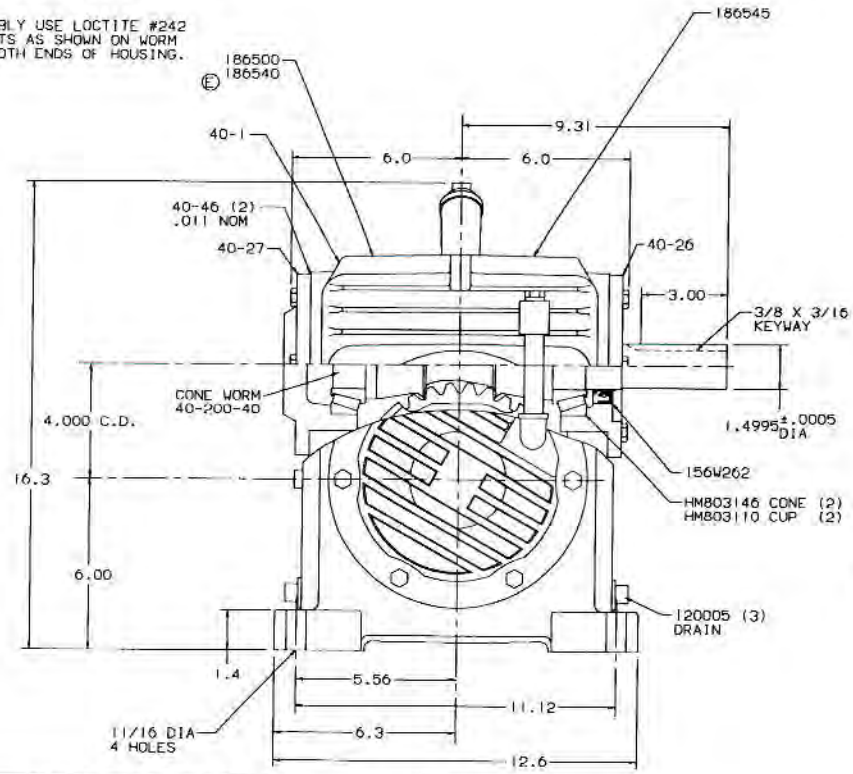
NOTE #3: FILL UNIT THRU BREATHER ELBOW UNTIL OIL DRANS OUT OF THE STANDPIPE ARRANGEMENT AND THEN RE-INSTALL BREATHER AND OIL LEVEL PLUG.

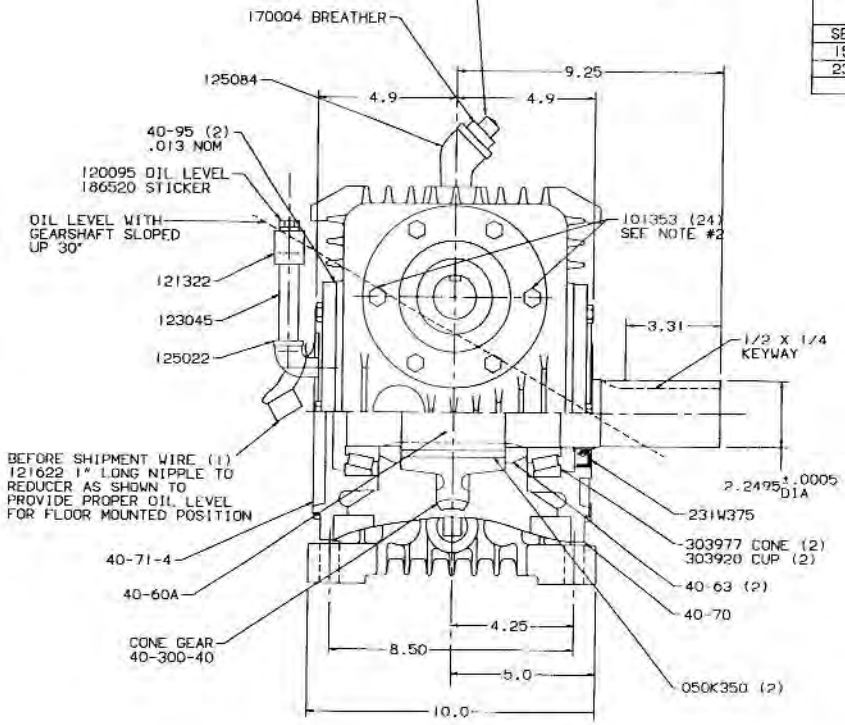
BOLT TORQUE CHART		
BOLT NO.	SIZE	TORQUE FT-LBS.
101353	3/8-24	20 - 30

POSITION DIMENSION FOR OIL SEAL SLEEVE

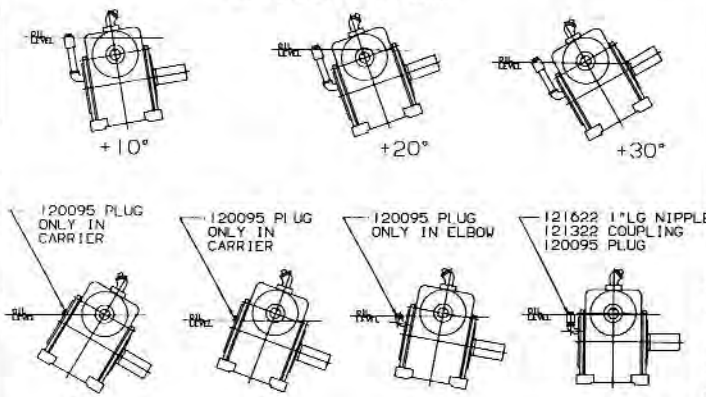
FROM OUTER FACE OF CAP OR CARRIER — D

SEAL NO	D
156W262	.58
231W375	.58





ALTERNATE VIEWS



MODEL H054204-2(S)

UNIT IS FURNISHED FOR MOUNTING AS SHOWN WITH GEARSHAFT SLOPE MOUNTED 10° 20° OR 30° UP CUSTOMER TO MODIFY OIL LEVEL ARRANGEMENT AS SHOWN IN ALTERNATE VIEWS FOR DIFFERENT SLOPE OR FLOOR MOUNTED POSITIONS

DUPPS PART NO. 116515
40:1 RATIO

LET.	REVISION	BY	DATE	APPD
E	ADDED 186540 (OIL TAG)	JMH	10-24-90	NJF
D	REDRAWN ON CAD-ADDED ALTERNATE MTG POSITIONS	KRD	11-27-89	HAW

REFERENCE DWGS.

MARK PART NUMBER

MATERIAL

HARDNESS

EST. WEIGHT

ROUTED BY PKM DATE

DRAWN DEN DATE 3-19-84

CHECKED NJF DATE 3-20-84

CONE DRIVE TEXTRON TRAVERSE CITY MICHIGAN U.S.A.

DESCRIPTION: 4.000 C.D. ASSEMBLY

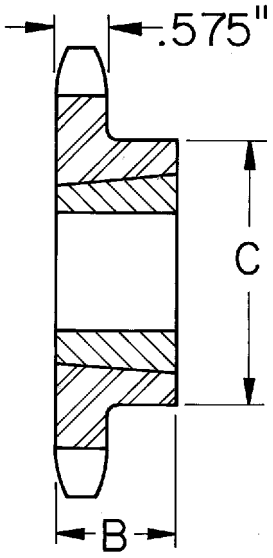
40:1 RATIO OVERSLUNG -SPECIAL-

DWG. NO. H054204-2(S)

DWG. SIZE D

DODGE®

No. 80 for 1″ Pitch Single Strand Chain



TYPE BTL

TAPER-LOCK								
No. Teeth	Spkt. O.D.	Description ★	Part No.	Spkt. Wt. w/o Bush.	C Hub Dia.	Bore Range		B
						Min.	Max.	
10	3.678	80BTL10H-1215	**100593**	1.2	2.38◆	1/2	1-1/4	1.50
11	4.006	80BTL11H-1215	**100594**	1.5	2.38◆			
12	4.332	80BTL12H-1615	**100595**	1.5	2.94◆			
13	4.657	80BTL13H-1615	**100596**	2.5	2.94	1/2	1-11/16	1.50
14	4.981	80BTL14H-1615	**100597**	2.9	3.25			
15	5.304	80BTL15H-1615	**100598**	3.0	3.25			
16	5.627	80BTL16H-2012	**100599**	3.0	3.56	1/2	2-1/8	1.25
17	5.949	80BTL17H-2012	**100600**	3.5				
18	6.271	80BTL18H-2012	**100601**	4.0				
19	6.593	80BTL19H-2012	**100602**	4.5				
20	6.914	80BTL20H-2517	**100603**	5.5	4.25	1/2	2-11/16	1.75
21	7.235	80BTL21H-2517	**100604**	6.1				
22	7.555	80BTL22H-2517	**100605**	6.7				
23	7.876	80BTL23H-2517	**100606**	7.2				
24	8.196	808TL24H-2517	**100607**	7.5				
25	8.516	80BTL25H-2517	**100608**	8.5				
26	8.836	80BTL26H-2517	**100609**	8.5				
27	9.156	80BTL27-2517	**100678**	9.8				
28	9.475	80BTL28-2517	**100679**	10.7				
29	9.795	80BTL29-2517	**104738**	11.5				
30	10.114	80BTL30-2517	**100610**	12.3				
31	10.434	80BTL31-2517	**104739**	12.8				
32	10.753	80BTL32-2517	**100611**	13.4				
33	11.073	80BTL33-2517	**104740**	14.1				
34	11.392	80BTL34-2517	**104741**	14.7				
35	11.711	80BTL35-2517	**100612**	15.6				
36	12.030	80BTL36-2517	**100613**	16.3				
37	12.349	80BTL37-2517	**104742**	17.2				
38	12.668	80BTL38-2517	**104743**	18.3				
39	12.987	80BTL39-2517	**104744**	19.4				
40	13.306	80BTL40-2517	**100614**	20.5				
41	13.625	80BTL41-2517	**104745**	22.2				
42	13.944	80BTL42-2517	**104746**	25.1				
44	14.582	80BTL44-2517	**104747**	28.4				
45	14.901	80BTL45-2517	**100615**	29.3				
48	15.857	80BTL48-2517	**100616**	34.6				
50	16.495	80BTL50-2517	**104748**	36.8				
54	17.769	80BTL54-2517	**100617**	39.0				
60	19.681	80BTL60-2517	**100618**	51.3				
70	22.867	80BTL70-3020	**100619**	65.8	5.25	7/8	3-1/4	2.00
80	26.052	80BTL80-3020	**100620**	77.3				

◆ Hub grooved for chain clearance.

★ "H" suffix indicates Hardened Teeth.

TAPER-LOCK SPROCKETS—Large Bore Series								
No. Teeth	Spkt. O.D.	Description ★	Part No.	Wt. w/o Bush.	C Hub Dia.	Bore Range		B
						Min.	Max.	
21	7.235	80BTL21HL-3020	**100695**	6.8	5.25	7/8	3-1/4	2.0
36	12.030	80BTL36L-3020	**100698**	17.0	5.25	7/8	3-1/4	2.0

★ "H" suffix indicates Hardened Teeth.

FEATURES/BENEFITS PAGE PT12–2	SELECTION PAGES PT12–28 - PT12–39	RELATED PRODUCTS PAGES PT12–40 - PT12–42	ENGINEERING/TECHNICAL PAGES PT12–43 -PT12–46

Product Detail

(3020) SPK ROLLER TB
80BTB70

A taper bushed sprocket is a sprocket where a tapered bushing is bolted into the taper bore that is machined in the sprocket. When installed this bushing is compressed onto the shaft providing a tight grip. Taper bushed sprockets have a tapered bushing bolted into a taper bore with hex head set screws instead of bolts.

Product Specifications

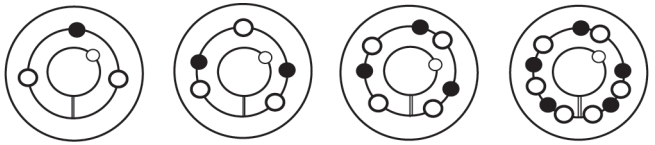
Material	Steel	Hub Recessed For Chain Clearance	No
Chain Number	80	Bore Type	Bushed TB
Chain Pitch	1.000 in.	Bushing Part Number	3020
Number of Chain Rows	1	Bushing Min Bore Size	0.938 in.
Number of Teeth	70	Bushing Max Bore Size	3.000 in.
Outside Diameter	22.867 in.	Individually Packaged	No
Pitch Diameter	22.289 in.	Storage Dimension Length	22.867 in.
Single Strand Tooth Thickness	0.575 in.	Storage Dimension Width	22.867 in.
Hardened Teeth	No	Storage Dimension Height	2.000 in.
Hub Configuration	B	Weight	52.35 lbs.
Hub Outside Diameter	5.250 in.		

TAPER-LOCK® Bushings

These instructions must be read thoroughly before installation or operation.

WARNING: To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

INSTALLATION:



1. Clean shaft, bore of bushing, outside of bushing and hub bore of all oil, paint and dirt. File away burrs.
2. Insert bushing into hub. Match the hole pattern, not threaded holes (each complete hole will be threaded on one side only).
3. "LIGHTLY" oil setscrews and thread into those half-threaded holes indicated by ○ on above diagram.

   CAUTION: Do not lubricate the bushing taper, bushing bore, hub taper or the shaft. Doing so could result in breakage of the product.

4. Position assembly onto shaft allowing for the small axial movement which will occur during lightening procedure.
5. Alternately torque setscrews to recommended torque setting in chart below.

   CAUTION: Do not use worn hex key wrenches. Doing so may result in a loose assembly or may damage screws.

6. To increase gripping force, lightly hammer face of bushing using drift or sleeve. (Do not hit bushing directly with hammer.)
7. Re-torque screws after hammering.

   CAUTION: Where bushing is used with lubricated products such as chain, gear or grid couplings be sure to seal all pathways (where lubrication could leak) with RTV or similar material.

8. Recheck screw torques after initial run-in, and periodically thereafter. Repeat steps 5, 6 and 7 if loose.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric nor are the responsibility of Baldor Electric. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

DODGE®

TO REMOVE:

1. Remove all screws.
2. Insert screws in holes indicated by ● on drawing. Loosen bushing by alternately tightening screws.

NOTE: If two bushings are used on the same component and shaft, fully tighten one bushing before working on another. When installing bushing in sintered steel product (sheave,coupling, etc.) follow torque recommendation shown on product hub if present.

Recommended Installation Wrench Torque		
Bushing No.	Lb.-In.	Nm
1008 1108 1210 1215 1310 1610 1615	55 55 175 175 175 175 175	6,2 6,2 19,9 19,9 19,9 19,9 19,9
2012 2517 2525 3020 3030	280 430 430 800 800	31,8 48,8 48,8 90,8 90,8
3525 3535 4030 4040 4535 4545	1000 1000 1700 1700 2450 2450	114 114 193 193 278 278
5040 5050 6050 7060 8065 10085 12010	3100 3100 7820 7820 7820 13700 13700	352 352 888 888 888 1556 1556

NOTE: When using TAPER-LOCK bushings with conveyor pulleys, refer to the DODGE Instruction Manual for TAPER-LOCK, H.E. , and QD Conveyor Pulley Bushings.

4044-0210

BALDOR

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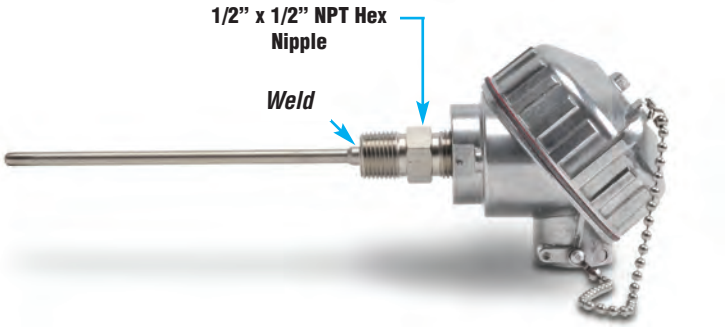
P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895
Dodge Product Support
6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433
www.baldor.com

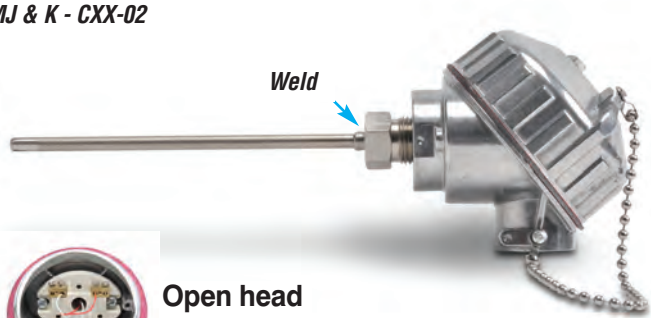
MN4044 (Replaces 499737)
2/11 TCP 25,000

Thermocouple Probes with Connection Head

THMJ & K - CXX-01 & 04



THMJ & K - CXX-02



Open head

THMJ & K - CXX-02 use ProSense Compression Fittings for Mounting

Overview

- All temperature sensors are pre-built stock items
- Probe
  - Type J or K thermocouple elements to meet many temperature sensing applications
  - 1/4" diameter, 316 SS or Inconel Alloy 600 sealed sheath to protect against harsh environments
  - Magnesium Oxide (MgO) insulation provides vibration dampening and protection against thermal shock
  - Bendable to adapt to installation requirements
  - 6", 12" or 18" proble length
- Connection Head
  - Cast aluminum NEMA 4X, IP66 screw cover head with captive gasket
  - One turn cover removal & installation eliminates cross threading and saves time
  - 3/4" NPT conduit opening with internal stop to prevent overtightening and installation damage
  - Gripping ribs on cover edge
  - Stainless steel cover chain
- Wiring
  - Ceramic terminal base
  - Brass terminals with stainless steel screws eliminate the need to wrap connections around screws
  - Elevated terminal block for easy wire termination
- Made in the USA

RoHS 2002/95/EC

Thermocouple Probes with Connnection Head - Types J and K

Part Number	Pcs/Pkg	Wt (lb)	Price	Type	Probe Diameter (O.D.)	Probe Length	Probe Material	Temperature Sensing Range	Mounting
THMJ-C06-01	1	1.3	<--->	J	1/4"	6"	316 stainless steel	0 to 720°C (32 to 1330°F)	Integral 1/2" x 1/2" NPT Hex Nipple, 316 SS
THMJ-C12-01			<--->	J		12"			
THMJ-C18-01			<--->	J		18"			
THMK-C06-01			<--->	K		6"		0 to 927°C (32 to 1700°F)	
THMK-C12-01			<--->	K		12			
THMK-C18-01			<--->	K		18"			
THMJ-C06-02			<--->	J		6"		0 to 720°C (32 to 1330°F)	ProSense compression fitting (see accessories - purchased separately)
THMJ-C12-02			<--->	J		12"			
THMJ-C18-02			<--->	J		18"			
THMK-C06-02			<--->	K		6"		0 to 927°C (32 to 1700°F)	
THMK-C12-02			<--->	K		12"			
THMK-C18-02			<--->	K		18"			
THMK-C06-04			<--->	K		6"	Inconel Alloy 600	0 to 1149°C (32 to 2100°F)	Integral 1/2" x 1/2" NPT Hex Nipple, 316 SS
THMK-C12-04			<--->	K		12"			
THMK-C18-04			<--->	K		18"			

Technical Specifications	
Junction Type	Ungrounded
ASTM E230 Standard Limits of Error	±2.2°C (±4.0°F) or 0.75%, whichever is greater
Probe	ø1/4", 316 stainless steel or Inconel Alloy 600 sheath, single thermocouple element is embedded in MgO powder
Probe Minimum Bend Radius	2 x sheath diameter
Minimum Installation Depth	3" (76 mm)
Connection Head	Die-cast aluminum, screw cover with stainless steel chain, compressed graphite gasket, NEMA 4X, IP66, 3/4" NPT conduit opening, max temp. 400°F (204°C)
Response Time	2.9 seconds, 63.2% of a 25-77°C step change per method ASTM E839
Wiring	Ceramic terminal base with brass terminals and stainless steel screws (Recommended tightening torque 3-4 lb-in)

NOTE: CHECK THE CHEMICAL COMPATIBILITY OF THE SENSOR'S WETTED PARTS WITH THE MEDIUM TO BE MEASURED.
Not designed for use in a thermowell. Use spring-loaded probe when installing in a thermowell.

Thermocouple and RTD Temperature Range

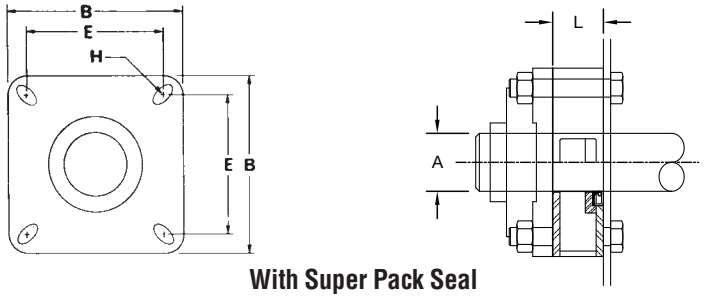
Thermocouple Temperature Range	
THMK-C06-04	32 to 2100°F (0 to 1149°C)
THMK-C12-04	
THMK-C18-04	
THMK-H06L01-03	
THMK-H12L01-03	
THMK-H18L01-03	
THMK-T06L06-03	32 to 2100°F (0 to 1149°C) lead wire transition rated to 204°C (400°F)
THMK-T12L06-03	
THMK-T18L06-03	
TTD25C-20-0300F-H	0 to 300°F (-17.8 to 148.9°C)
TTD25N-20-0300F-H	
THMJ-A01L04-01	32 to 900°F (0 to 482°C)
THMJ-A01L06-01	
THMJ-A01L10-01	
THMJ-A01L10-02	
THMJ-B01L06-01	
THMJ-B01L06-02	
THMJ-B02L06-01	
THMJ-B02L06-02	
THMJ-D08L04-01	
THMJ-D08L06-01	
THMJ-D08L10-01	
THMJ-D08L10-02	
THMK-A01L04-01	
THMK-A01L06-01	
THMK-A01L10-01	
THMK-A01L10-02	
THMK-B01L06-01	
THMK-B01L06-02	
THMK-D08L04-01	
THMK-D08L06-01	
THMK-D08L10-01	
THMK-D08L10-02	
THMJ-T06L06-01	32 to 970°F (0 to 521°C), lead wire transition rated to 400 °F (204 °C)
THMJ-T12L06-01	
THMJ-T18L06-01	
THMJ-P06-01	32 to 970°F (0 to 521°C), plug rated to 400 °F (204 °C)
THMJ-P12-01	
THMJ-P18-01	
THMJ-C04-03	32 to 1330°F (0 to 720°C)
THMJ-C04R-03	
THMJ-C06-01	
THMJ-C06-02	
THMJ-C06-03	
THMJ-C06R-03	
THMJ-C12-01	
THMJ-C12-02	
THMJ-C12-03	
THMJ-C12R-03	
THMJ-C18-01	
THMJ-C18-02	
THMJ-H04L01-02	
THMJ-H06L01-01	
THMJ-H06L01-02	
THMJ-H12L01-01	
THMJ-H12L01-02	
THMJ-H18L01-01	

Thermocouple Temperature Range	
THMJ-T06L06-02	32 to 1330°F (0 to 720°C) lead wire transition rated to 400 °F (204 °C)
THMJ-T12L06-02	
THMJ-T18L06-02	
THMJ-P06-02	32 to 1330°F (0 to 720°C) plug rated to 400 °F (204 °C)
THMJ-P12-02	
THMJ-P18-02	
THMK-C04-03	32 to 1700°F (0 to 927°C)
THMK-C04R-03	
THMK-C06-01	
THMK-C06-02	
THMK-C06-03	
THMK-C06R-03	
THMK-C12-01	
THMK-C12-02	
THMK-C12-03	
THMK-C12R-03	
THMK-C18-01	
THMK-C18-02	
THMK-H04L01-02	
THMK-H06L01-01	
THMK-H06L01-02	
THMK-H12L01-01	
THMK-H12L01-02	
THMK-H18L01-01	
THMK-T06L06-01	32 to 1700°F (0 to 927°C) lead wire transition rated to 400 °F (204 °C)
THMK-T06L06-02	
THMK-T12L06-01	
THMK-T12L06-02	
THMK-T18L06-01	
THMK-T18L06-02	
THMK-P06-01	32 to 1700°F (0 to 927°C) plug rated to 400 °F (204 °C)
THMK-P06-02	
THMK-P12-01	
THMK-P12-02	
THMK-P18-01	
THMK-P18-02	
THMK-B02L06-01	32° to 900°F (0° to 482°C)
THMK-B02L06-02	
THMT-P06-01	-328 to 700°F (-200 to 371°C) plug rated to 400 °F (204 °C)
THMT-P12-01	
THMT-P18-01	
THMT-T06L06-01	-328 to 700°F (-200 to 371°C), lead wire transition rated to 400 °F (204 °C)
THMT-T12L06-01	
THMT-T18L06-01	
TTD25C-20-0100C-H	32 to 212°F (0 to 100°C)
TTD25N-20-0100C-H	
TSD25N-0P-0284-H	-4 to 284°F (-20 to 140°C)
TSD25N-AP-0284-H	

RTD Temperature Range	
RTD1-R01-01	40 to 185°F (-40 to 85°C)
RTD1-S04-01	-58 to 572°F (-50 to 300°C)
RTD1-S04-02	
RTD1-S04-03	
RTD1-S04-04	
RTD1-B01L06-01	
RTD1-B02L06-01	
RTD1-C04-03	
RTD1-C04R-03	
RTD1-C06-01	
RTD1-C06-03	
RTD1-C06R-03	
RTD1-C12-01	
RTD1-C12-02	
RTD1-C12-03	
RTD1-C12R-03	
RTD1-C18-01	
RTD1-C18-02	
RTD1-H04L01-02	
RTD1-H06L01-01	
RTD1-H06L01-02	
RTD1-H12L01-01	
RTD1-H12L01-02	
RTD1-H18L01-01	
RTD1-P06-01	-58 to 572°F (-50 to 300°C) Plug rated to 400°F (204°C)
RTD1-P12-01	
RTD1-P18-01	
RTD1-D08L10-01	-58 to 572°F (-50 to 300°C), lead wire transition rated to 400°F (204°C)
RTD1-T06L06-01	
RTD1-T12L06-01	
RTD1-T18L06-01	

J, K, & T Thermocouple Color Code		
J	White	+
	Red	-
K	Yellow	+
	Red	-
T	Blue	+
	Red	-

Super Pack Seal



With Super Pack Seal

A Shaft	Part Number	B	L	E		H Bolts		Weight
				(–B)	(–R)	(–B)	(–R)	
1½	MSP3	5⅜	1¾	4	4⅛	½	½	6
2	MSP4	6½	1¾	5⅛	4⅜	⅝	½	8
2 7/16	MSP5	7⅜	1¾	5⅝	5⅜	⅝	⅝	10
3	MSP6	7¾	1¾	6	6	¾	¾	13
3 3/16	MSP7	9¼	2¼	6¾	7	¾	¾	16

Martin Super Pack Seal combines the heavy duty waste pack housing with the superior sealing characteristics of a Super Pack Seal. Seal may also be air or grease purged for difficult sealing applications.

RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 4
Inlet Screw

1813 Frank Holt Drive Burlington NC 27215 336-226-1100 rendeq.com

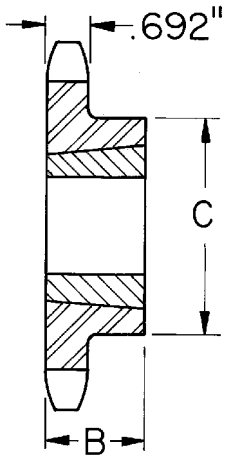
RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC. GTAF System
INLET SCREW

Item	Qty	Part Numbers/ Description
Chain	~7ft.	100 Single Riveted Roller Chain
Motors	3	(1)Baldor VWDM3546 (1) Baldor VM3546 (1) Baldor CWDM3615T
Gearboxes	3	(1) Conedrive 20:1 Ratio (2) 90 Degree Gearboxes
Sprockets	2	(1) Dodge 100637 (1)Martin 100BT353020
Bushings	1	Dodge F4B-L10-200, 033213
Coupling & Spider	1 set	(2) L-100 1-1/8” Bore Coupling (1) Spider L-100
Limit Switches	4	Square D 9007C54J

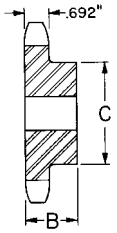
No. 100 for 1-1/4″ Pitch Single Strand Chain



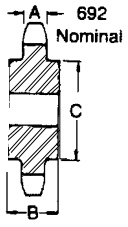
TYPE BTL

TAPER-LOCK								
No. Teeth	Spkt. O.D.	Description ★	Part No.	Wt. w/o Bush.	C. Hub Dia.	Bore Range Min.	Bore Range Max.	B
11 12	5.008 5.415	100BTL11H-1615 100BTL12H-1615	**100621** **100622**	2.7 3.1	3.00 3.25	1/2	1-11/16	1.50
13 14	5.821 6.226	100BTL13H-2012 100BTL14H-2012	**100623** **100624**	3.0 4.0	3.56	1/2	2-1/8	1.25
15 16 17	6.630 7.034 7.436	100BTL15H-2517 100BTL16H-2517 100BTL17H-2517	**100625** **100626** **100627**	5.5 6.0 7.0	4.25 4.25 4.25	1/2	2-11/16	1.75
18 19 20 21	7.839 8.241 8.643 9.044	100BTL18H-2517 100BTL19H-2517 100BTL20H-2517 100BTL21H-2517	**100628** **100629** **100630** **100631**	7.5 9.7 9.8 10.6	4.25	1/2	2-11/16	1.75
21 22 23	9.044 9.444 9.845	100BTL21HL-3020 100BTL22H-2517 100BTL23H-2517	**100694** **100632** **104753**	12.5 11.4 15.0	5.25 4.25 4.25	7/8 1/2 1/2	3-1/4 2-11/16 2-11/16	2.0 1.75 1.75
24 25 26	10.245 10.645 11.045	100BTL24H-2517 100BTL25H-2517 100BTL26-2517	**100633** **104754** **100634**	14.3 17.0 16.0	4.50	1/2	2-11/16	1.75
28 30 32 35	11.844 12.643 13.441 14.639	100BTL28-3020 100BTL30-3020 100BTL32-3020 100BTL35-3020	**100685** **100635** **100636** **100637**	20.2 21.5 25.0 30.2				
36 40 42 45	15.038 16.633 17.430 18.626	100BTL36-3020 100BTL40-3020 100BTL42-3020 100BTL45-3020	**100638** **100639** **104755** **100640**	31.4 36.6 43 47	5.25	7/8	3-1/4	2.0
48 54 60	19.821 22.211 24.601	100BTL48-3020 100BTL54-3020 100BTL60-3020	**100641** **100642** **100643**	60 77 94				

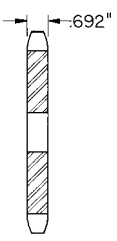
★ "H" suffix indicates Hardened Teeth.



TYPE B



TYPE C



TYPE A

REBORABLE—TYPE B & C										PLATE—TYPE A			
No. Teeth	Type	Spkt. O.D.	Descr. ★	Part No.	Wt.	Bore Stock	Bore Max.	B	C Hub Dia.	Spkt. No.	Part No.	Wt.	Stock Bore
10	B	4.598	100B10	**105366**	5.0	1	1-7/8	1.88	3.25†	.....	.....	....	....
11	B	5.008	100B11	**105132**	5.2	1	2-1/4	1.88	3.56†	100A11	**103164**	3.4	1
12	B	5.415	100B12	**105133**	5.4	1	2-1/4	1.88	4.00†	100A12	**103165**	4.1	1
13	B	5.821	100B13	**105134**	6.6	1	2-3/8	1.63	3.78	100A13	**103166**	4.7	1
14	B	6.226	100B14	**105135**	8.5	1-1/4	2-3/4	1.63	4.19	100A14	**103167**	5.4	1-1/4
15	B	6.630	100B15	**105136**	9.4	1-1/4	3	1.75	4.50	100A15	**103168**	6.2	1-1/4
16	B	7.034	100B16	**105137**	10	1-1/4	3	1.75	4.50	100A16	**103169**	7.0	1-1/4
17	B	7.436	100B17	**105138**	11	1-1/4	3	1.75	4.50	100A17	**103170**	7.8	1-1/4
18	B	7.839	100B18	**105139**	12	1-1/4	3	1.75	4.50	100A18	**103171**	8.7	1-1/4
19	B	8.241	100B19	**105140**	13	1-1/4	3	2.0	4.50	100A19	**103172**	9.6	1-1/4
20	B	8.643	100B20	**105141**	14	1-1/4	3	2.0	4.50	100A20	**103173**	10.6	1-1/4
21	B	9.044	100B21	**105142**	16	1-1/4	3	2.0	4.50	100A21	**103174**	11.7	1-1/4
22	B	9.444	100B22	**105143**	17	1-1/4	3	2.0	4.50	100A22	**103175**	12.7	1-1/4
23	B	9.845	100B23	**105367**	18	1-1/4	3	2.0	4.50	100A23	**103176**	13	1-1/4
24	B	10.245	100B24	**105144**	19	1-1/4	3	2.0	4.50	100A24	**103177**	14	1-1/4
26	B	11.045	100B26	**105145**	21	1-3/8	3-5/16	2.0	5.0	100A26	**103178**	17	1-3/8
28	B	11.844	100B28	**105368**	25	1-3/8	3-5/16	2.0	5.0	100A28	**103179**	19	1-3/8
30	B	12.643	100B30	**105146**	27	1-3/8	3-5/16	2.0	5.0	100A30	**103180**	22	1-3/8
32	B	13.441	100B32	**105147**	30	1-3/8	3-5/16	2.0	5.0	100A32	**103181**	26	1-3/8
35	B	14.639	100B35	**105369**	34	1-3/8	3-5/16	2.0	5.0	100A35	**103182**	30	1-3/8
36	B	15.038	100B36	**105148**	39	1-3/8	3-5/16	2.50	5.0	100A36	**103183**	33	1-3/8
40	B	16.633	100B40	**105149**	47	1-3/8	3-5/16	2.50	5.0	100A40	**103184**	40	1-3/8
42	–	–	–	–	–	–	–	–	–	100A42	**103185**	44	1-3/8
45	B	18.626	100B45	**105371**	55	1-3/8	3-5/16	2.50	5.0	100A45	**103186**	50	1-3/8
48	B	19.821	100B48	**105372**	66	1-3/8	4-1/8	2.75	6.25	100A48	**103187**	57	1-3/8
54	C	22.211	100C54	**105411**	78	1-3/8	4-1/8	3.25	6.25	100A54	**103188**	71	1-3/8
60	C	24.601	100C60	**105412**	90	1-3/8	4-1/8	3.75	6.25	100A60	**103189**	88	1-3/8
70	C	28.584	100C70	**105220**	125	1-3/8	5-1/4	3.75	7.0	100A70	**103190**	118	1-3/8
80	C	32.565	100C80	**105221**	151	1-3/8	5-1/4	3.75	7.0	100A80	**103191**	157	1-3/8

See List Price Book MLP for alteration charges. † Hub Extends opposite face of dwg.

FEATURES/BENEFITS PAGE PT12–2	SELECTION PAGES PT12–28 - PT12–39	RELATED PRODUCTS PAGES PT12–40 - PT12–42	ENGINEERING/TECHNICAL PAGES PT12–43 -PT12–46

Instruction Manual
DODGE® SOLIDLUBE Bearings
700, 1000 and 800 Series

These instructions must be read thoroughly before installation or operation.

INSTALLATION and OPERATION:

Solid Film Lubrication:

Solid film lubricating bearing material will transfer a film or coating of lubricant to the shaft as the shaft rotates. This film or coating prevents metal to metal contact between the shaft and bearing material, as the shaft actually rides upon the lubricant and not upon the bearing itself. Because it is a solid, the lubricant will not squeeze out when the shaft is not rotating, The bearing will not need additional lubrication since the solid lubricant is impregnated into the bushing material and is transferred or "worn" onto the rotating shaft at a rate determined by the rubbing speed of one material to the other and the imposed load. Since this is a "wear type" bushing, wear will be experienced under normal operating conditions.

NOTE: SOLIDLUBE bearings are not designed for rotating housing applications.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a fail safe device must be an integral part of the driven equipment beyond the speed reducer output shaft.

Installation:

Shaft preparation: The bearing journal should not be exposed to grease, oils or dirt to insure good life of the bearing. **NO OIL OR GREASE SHOULD BE USED ON THE BUSHING OR SHAFT WHEN ASSEMBLING THIS BEARING.** The shaft should be clean and free of burrs and nicks. The shaft should be held to a minimum amount of taper and as little eccentricity as possible so a uniformly distributed rubbing surface can be maintained. For best results, the shaft finish should be held to 10 to 20 micro-inches (0.25 to 0.50 micro-meters) and hardness should be 35 Rockwell "C" or higher. Shaft tolerance should be +0.000/-0.002 inches (+0.000/-0.051 millimeters) for commercial steel shafting.

NOTE: The SOLIDLUBE bearing has a high coefficient of friction which can result in stalling when many bearings run off the same drive system. Please contact Baldor Electric Company for further information.

Installation of LT, LTB and LM Pillow Block Assembly:

NOTE: The 1000 Series bushings may have a white film in the bore which should be wiped off with a clean cloth before assembly.

1. Slide the assembled pillow block on the shaft.
2. Align the pillow block on the shaft and tighten the hold-down bolts. Shim the pillow block base, if necessary.

NOTE: Inner unit assemblies are installed properly at the factory. For added service, the bearing inner unit may be rotated 180° while on the shaft to utilize a new bearing surface.

CAUTION: Units should not be rotated 180° with the stop-pin in place as this may restrict self-aligning capabilities.

Installation of MM Pillow Block Assemblies:

1. Loosen the cap bolts being careful not to lose housing shims.
2. Slide the assembled pillow block on the shaft and position for mounting.
3. Insert hold-down bolts but do not tighten.
4. Align the bearing with the shaft using shims when necessary and tighten hold-down bolts.
5. Rotate shaft to allow the inner unit to align itself in the outer housing and tighten the bearing cap bolts.

NOTE: Inner unit assemblies are installed properly at the factory. For added service, the bearing inner unit may be rotated 180º while on the shaft to utilize a new bearing surface.

CAUTION: Units should not be rotated 180º with the stop-pin in place as this may restrict self-aligning capabilities.

Thrust Loads:

Shaft locating collars may be used for slight amounts of thrust loads only. Total collar to bearing clearance should be .010 to .020 inches or .005 to .010 inches per collar.

Running In:

To improve life expectancy from this type of bearing, a brief run-in or break-in can be performed. This may not be possible, but to obtain optimal service, it is advisable to break in this type of bearing. The break-in should be run with a bearing mounted on its mating shaft, as in service, with all possible loading removed. The break-in period will build up the solid film of lubricant on the shaft to reduce potential start-up damage to the bushing.

Shaft Corrosion:

When commercial steel shafting is exposed to corrosive media, the shaft will oxidize, (rust), pit, etc. The SOLIDLUBE bushing is chemically inert but a rusty shaft will grow into the SOLIDLUBE bushing, thus eliminating clearances and restricting movement. Corrective action is to use corrosive resistant shafting such as stainless steel and/or to provide for regularly scheduled movement of the shaft.

Special Operating Conditions:

Consult Baldor Electric Company, Dodge Engineering, Greenville, SC for application assistance, acid, chemical, extreme or other special conditions.

3049-0712

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A MEMBER OF THE ABB GROUP

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Dodge Product Support
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www.baldor.com

MN3049 (Replaces 499954 & 499964) 07/12 TCP 25,000

Limit Switches—Class 9007 Type C
Interruptores de límite—clase 9007 tipo C
Interrupteurs de position—classe 9007 type C

Replaces / Reemplaza / Remplace 65013-309-03 08/2001

Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power supplying this equipment before working on it.

Failure to follow these instructions will result in death or serious injury.

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O ARCO ELECTRICO

Desenergice el equipo antes de realizar cualquier trabajo en él.

Si no se siguen estas instrucciones provocará lesiones graves o incluso la muerte.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ARC ELECTRIQUE

Coupez l'alimentation de cet appareil avant d'y travailler.

Le non-respect de ces instructions provoquera la mort ou des blessures graves.

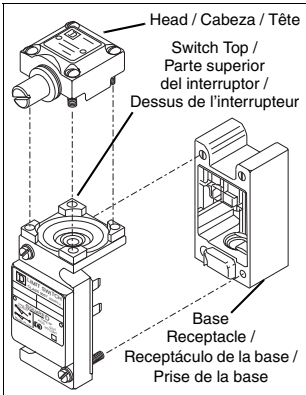


Figure / Figura / Figure 1

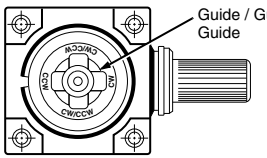


Figure / Figura / Figure 2

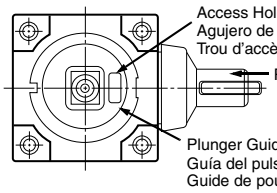


Figure / Figura / Figure 3

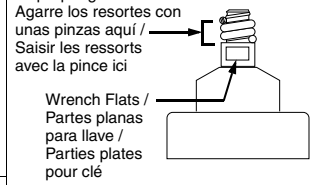


Figure / Figura / Figure 4

For complete application data, see product data bulletin SM444R1.

Para obtener los datos de aplicación completos, consulte el boletín de datos del producto no. SM444R1.

Pour des données complètes d'application, voir la fiche technique n° SM444R1.

CONVERSION OF HEADS

Head Rotation—All Types

All heads can be rotated to one of four positions, 90° apart. See Figure 1.

1. Loosen the four head mounting screws.
2. Rotate the head to the desired position and tighten the screws.

Mode of Operation—Lever Types A, B, and N

The mode of operation converts easily to clockwise (CW), counterclockwise (CCW), or both (CW/CCW). See Figure 2.

1. Loosen the four head mounting screws and remove the head.
2. Pull up on the guide and position it so that the arrow points to the desired letters: CW, CCW, or CW/CCW.

CONVERSION DE LAS CABEZAS

Giro de la cabeza—todos los tipos

Todas las cabezas se pueden girar a una de las cuatro posiciones, 90° separadas. Vea la figura 1.

1. Afloje los cuatro tornillos de montaje de la cabeza.
2. Gire la cabeza a la posición deseada y apriete los tornillos.

Modo de funcionamiento—palanca tipos A, B y N

El modo de funcionamiento se puede convertir fácilmente en el sentido de las manecillas del reloj (CW) o en sentido contrario a las manecillas del reloj (CCW), o ambos (CW/CCW). Vea la figura 2

1. Afloje los cuatro tornillos de montaje de la cabeza y retire esta última.
2. Jale la guía hacia arriba y colóquela de tal manera que la flecha señale las letras deseadas: CW, CCW o CW/CCW.

CONVERSION DES TÊTES

Rotation des têtes—Tous les types

Toutes les têtes peuvent être tournées à l'une des quatre positions à 90 ° d'intervalle. Voir la figure 1.

1. Desserrer les quatre vis de montage de la tête.
2. Faire tourner la tête à la position désirée et serrer les vis.

Mode de fonctionnement—levier de types A, B et N

Le mode de fonctionnement peut facilement être converti en mode sens horaire (CW), anti-horaire (CCW) ou aux deux (CW/CCW). Voir la figure 2.

1. Desserrer les quatre vis de montage de la tête et enlever la tête.
2. Tirer sur le guide et le placer de sorte que la flèche soit orientée vers les lettres désirées : CW, CCW ou CW/CCW.

3. Push the guide back down into the slots.
4. Reassemble the head in the desired position.
   NOTE: CW or CCW refers to the operation.

Side Plunger Roller Operation—Type F

The switch comes with the roller in the vertical position. It can be rotated 90° to a horizontal position. See Figure 3.

1. Loosen the four head mounting screws and remove the head.
2. Depress and hold in the roller plunger.
3. Insert the blade of a flat-head screwdriver through the access hole in the plunger guide to hold the white nylon cam inside the head. Pull out the roller plunger.
4. Rotate the roller plunger 90° and remove the screwdriver blade.
5. Make sure the guide pin in the plunger is seated in the slot of the nylon cam and reassemble the head in the desired position.

INSTALLATION

1. When assembling or replacing the switch top assembly (Figure 1), be sure that the gasket surface is clean and in position. Tighten the switch's top fastening screws to 20–30 lb-in (2.26–3.39 N•m), to ensure proper sealing and electrical integrity.

2. When assembling or replacing heads (Figure 1), always tighten the head fastening screws to 20–30 lb-in (2.26–3.39 N•m), to ensure proper operation and adequate sealing.
3. When connecting the conduit to the base receptacle (Figure 1), use tight fittings and apply a sealing compound to the threads for best sealing.

   NOTE: On devices with maintained contact heads, the wiring diagram on the nameplate and the base casting reflects the contact status when the shaft is in the CCW position (Type C heads) or Reset position (Type H heads).

3. Empuje la guía en las ranuras.

4. Vuelva a ensamblar la cabeza en la posición deseada.
   NOTA: CW o CCW se refieren al funcionamiento.

Funcionamiento del pulsador con roldana lateral—tipo F

El interruptor esta provisto con una roldana en posición vertical. La roldana se puede girar 90° en la posición horizontal. Vea la figura 3.

1. Afloje los cuatro tornillos de montaje de la cabeza y retire esta última.
2. Baje el pulsador con roldana y sosténgalo en esa posición.
3. Inserte la punta plana de un desarmador por el agujero de acceso en la guía del pulsador para sostener la leva de nylon blanco dentro de la cabeza y jale el pulsador con roldana hacia afuera.
4. Gire el pulsador con roldana 90° y retire la punta del desarmador.
5. Asegúrese de que la espiga de la guía en el pulsador esté bien colocada en la ranura de la leva de nylon y vuelva a ensamblar la cabeza en la posición deseada.

INSTALACION

1. Cuando instale o reemplace el ensamble de la parte superior del interruptor (figura 1), asegúrese de que esté limpia la superficie del empaque y que se encuentre en su posición. Apriete los tornillos de sujeción de la parte superior del interruptor en 2.26–3.39 N•m (20–30 lbs-pulg), para asegurar un cierre hermético adecuado y la integridad eléctrica.
2. Cuando instale o reemplace las cabezas (figura 1), siempre apriete los tornillos de sujeción de la cabeza en 2.26–3.39 N•m (20–30 lbs-pulg), para asegurar un funcionamiento correcto y el cierre hermético adecuado.
3. Cuando realice las conexiones del tubo conduit en el receptáculo de la base (figura 1), apriete los adaptadores y aplique un compuesto de cierre hermético a las roscas para obtener mejores cierres.
   NOTA: En los dispositivos con cabezas de contacto sostenido, el diagrama de cableado en la placa de identificación y la pieza fundida de la base reflejan el estado del contacto cuando el eje se encuentra en la posición CCW (cabezas tipo C) o en la posición de restablecimiento (cabezas tipo H).

3. Enfoncer le guide dans les fentes.

4. Réassembler la tête dans la position désirée.
   REMARQUE : CW ou CCW se réfèrent au fonctionnement.

Fonctionnement du poussoir à galet latéral—type F

L'interrupteur est fourni avec le galet en position verticale. Le galet peut être tourné de 90 ° à la position horizontale. Voir la figure 3.

1. Desserrer les quatre vis de montage de la tête et enlever la tête.
2. Appuyer sur le poussoir à galet et le maintenir enfoncé.
3. Introduire la lame d'un tournevis plat dans le trou d'accès du guide de poussoir pour retenir la came de nylon blanc à l'intérieur de la tête et faire sortir le poussoir à galet en le tirant.
4. Faire tourner le poussoir à galet de 90 ° et enlever la lame du tournevis.
5. S'assurer que la goupille de guide du poussoir est installée dans la fente de la came de nylon et réassembler la tête dans la position désirée.

INSTALLATION

1. Lors de l'assemblage ou du remplacement de l'ensemble de dessus de l'interrupteur (figure 1), s'assurer que la surface du joint est propre et dans la bonne position. Serrer les vis d'attache du dessus de l'interrupteur à un couple entre 2.26 et 3.39 N•m (20 et 30 lbs-po), pour assurer la bonne étanchéité et l'intégrité électrique.

2. Lors de l'assemblage ou du remplacement des têtes (figure 1), toujours serrer les vis d'attache de la tête à un couple entre 2.26 et 3.39 N•m (20 et 30 lbs-po), pour assurer le bon fonctionnement et la bonne étanchéité.
3. Lors de l'installation du conduit de la prise de base (figure 1), bien serrer les adaptateurs et utiliser un produit d'étanchéité sur les filetages pour assurer une meilleure étanchéité.

   REMARQUE : Sur les appareils avec des têtes à contact maintenu, le schéma de câblage sur la plaque signalétique et le moulage de base indique l'état du contact lorsque l'arbre est dans la position anti-horaire (têtes de type C) ou dans la position de réinitialisation (têtes de type H).

CAM Design Data / Datos de diseño de la leva / Données de conception de la CAME

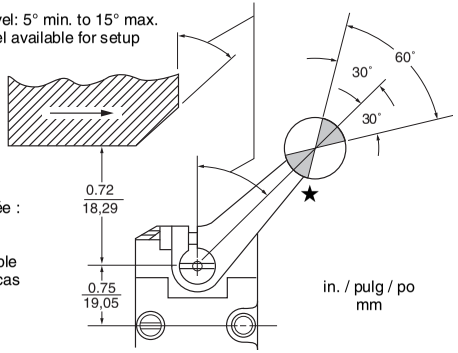
Leading Edge / Borde anterior / Bord antérieur

Make these angles approximately the same, 45° recommended
Haga que los ángulos sean aproximadamente del mismo tamaño, se recomiendan 45°
Ces angles doivent être approximativement les mêmes, 45 ° est recommandé

Recommended overtravel: 5° min. to 15° max.
Use additional overtravel available for setup and emergency only.

Sobrerecorrido recomendado:
mín. 5°; máx. 15°
Use el sobrerecorrido adicional disponible sólo para la instalación y emergencias.

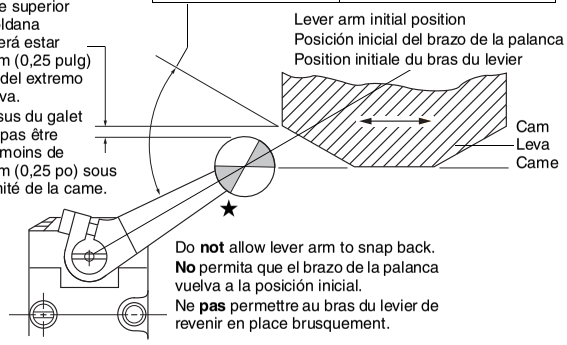
Surcourse recommandée :
min. 5 °; max. 15 °
Utiliser la surcourse supplémentaire disponible pour l'installation et en cas d'urgence uniquement.



Trailing Edge / Borde posterior / Bord arrière

Top of roller should not be less than 0.25 in. (6.35 mm) below end of cam.
La parte superior de la roldana no deberá estar 6,35 mm (0,25 pulg) debajo del extremo de la leva.
Le dessus du galet ne doit pas être situé à moins de 6,35 mm (0,25 po) sous l'extrémité de la came.

60 ° MAX.	Reversing Cam Leva reversible Came réversible	80 ° MAX.	Non-reversing Cam Leva no reversible Came non réversible



Do **not** allow lever arm to snap back.
No permita que el brazo de la palanca vuelva a la posición inicial.
Ne **pas** permettre au bras du levier de revenir en place brusquement.

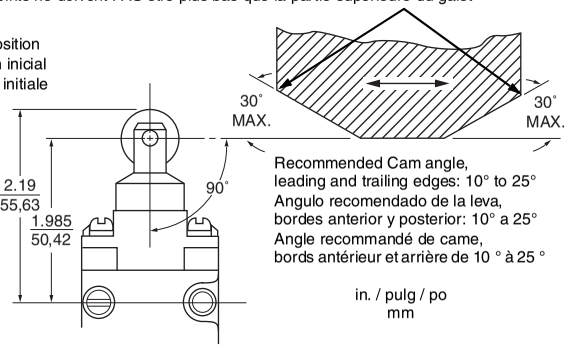
★ Do **not** contact roller within the shaded area / **No** permite que la roldana tenga contacto con el área sombreada / Ne **pas** entrer en contact avec le galet dans la zone ombrée
High Speed Cams (90 FPM or more), see SM444R1. / Levas de alta velocidad (0,46 MPS o más), vea SM444R1. / Cames grande vitesse (90 pi/m ou plus), voir SM444R1.

Figure / Figura / Figure 5 : Lever Type / Tipo palanca / Type du levier

Top Roller Plunger / Pulsador de roldana superior / Poussoir à galet supérieur

These points must NOT be lower than the top of the roller.
Estos puntos NO deberán estar más bajos que la parte superior de la roldana.
Ces points ne doivent PAS être plus bas que la partie supérieure du galet

Initial Position
Posición inicial
Position initiale

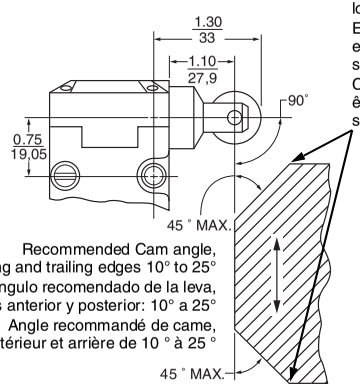


Recommended Cam angle, leading and trailing edges: 10° to 25°
Angulo recomendado de la leva, bordes anterior y posterior: 10° a 25°
Angle recommandé de came, bords antérieur et arrière de 10 ° à 25 °

in. / pulg / po
mm

Side Roller Plunger / Pulsador con roldana lateral / Poussoir à galet latéral

These points must NOT be lower than the top of the roller.
Estos puntos NO deberán estar más bajos que la parte superior de la roldana.
Ces points ne doivent PAS être plus bas que la partie supérieure du galet



Recommended Cam angle, leading and trailing edges 10° to 25°
Angulo recomendado de la leva, bordes anterior y posterior: 10° a 25°
Angle recommandé de came, bords antérieur et arrière de 10 ° à 25 °

in. / pulg / po
mm

Figure / Figura / Figure 6 : Roller Plunger Type / Tipo pulsador con roldana / Type de poussoir à galet

Wobble Stick

When changing or installing wobble stick extensions on Types J, K, KC, or JKC (Figure 4), use a 1/4 in. open-end wrench to prevent the shaft from turning. Grip the extension spring with pliers and turn CCW to remove or CW to install. The extensions are interchangeable.

Replacement Parts

Heads, switch top assemblies, and base receptacles are available as replacement parts. To order, specify the Type number marked on the individual component, or refer to the *Digest*.

- Type C limit switches, when fully assembled, are designed to be operationally interchangeable with Type B limit switches. However, individual components (heads, switch tops, and base receptacles) are not interchangeable with the Type B components.
- On Type C limit switch plunger devices, the cam track dimension is the same as on the Type B *non-plug-in* devices, but 0.22 in. (5.6 mm) less than on the Type B *plug-in* devices. If this creates a problem, a 9007 CT10 adapter plate is available.

- Types C68, CO68, CT68, T5, and T10 neutral position limit switch components are **not** interchangeable with **any** other Type C limit switch components **including** Types C64, CO64, CT64, and BW.
- Type CO plug-in units are UL Listed only when used with 9007 CT base receptacles.

- Class 9007 Type C limit switches comply with IEC 60957.5.1, SC 8.3.4 when protected with a Bussmann CC KTK-R-10 fuse.

Varilla oscilante

Cuando se cambian o instalan extensiones de varilla oscilante en los tipos J, K, KC, o JKC (figura 4), utilice una llave española de 1/4 pulg para evitar que gire el eje. Agarre el resorte de la extensión con unas pinzas y gire hacia CCW para retirar la extensión o gire hacia CW para instalarla. Las extensiones son intercambiables.

Piezas de repuesto

Las cabezas, los ensambles de la parte superior del interruptor y los receptáculos de la base se pueden obtener como piezas de repuesto. Para solicitarlos, especifique el número de tipo del componente individual o consulte el *Compendiado*.

- Los interruptores de límite tipo C, cuando están completamente instalados, han sido diseñados para ser funcionalmente intercambiables con los interruptores de límite tipo B. Sin embargo, los componentes individuales (cabezas, partes superiores del interruptor y receptáculos de la base) no se pueden intecambiar con los componentes del interruptor tipo B.
- La medida de la trayectoria de la leva de los dispositivos del pulsador del interruptor de límite tipo C es la misma que para los dispositivos *no enchufables* tipo B, pero 5,6 mm (0,22 pulg) menor que la de los dispositivos *enchufables* tipo B. Si esto le crea problemas, se encuentra disponible una placa adaptadora 9007 CT10.
- Los componentes de los interruptores de límite de posición neutra tipos C68, CO68, CT68, T5 y T10 **no** son intercambiables con **ningun** otro componente de los interruptores de límite tipo C **incluyendo** los tipos C64, CO64, CT64 y BW.
- Las unidades enchufables tipo CO están registrados por UL solamente cuando se utilizan con los receptáculos de base clase 9007 CT.
- Los interruptores de límite clase 9007 tipo C cumplen con el requisito IEC 60957.5.1, SC 8.3.4 cuando están protegidos con un fusible Bussmann CC KTK-R-10.

Tige à ressort

Lors du changement ou de l'installation de rallonges de tige à ressort sur les types J, K, KC, ou JKC (figure 4), utiliser une clé plate de 1/4 po pour empêcher l'arbre de tourner. Saisir le ressort de la rallonge avec des pinces et tourner dans le sens anti-horaire pour démonter ou tourner dans le sens horaire pour installer. Les rallonges sont interchangeables.

Pièces de rechange

Les têtes, les assemblages de la partie supérieure de l'interrupteur et les réceptacles de base peuvent être obtenus comme pièces de rechange. Pour les commander, spécifier le numéro de type inscrit sur le composant individuel ou se reporter au *Digest*.

- Les interrupteurs de position de type C, lorsqu'ils sont complètement assemblés, sont conçus pour être fonctionnellement interchangeables avec les interrupteurs de position de type B. Toutefois, les composants individuels (têtes, parties supérieures de l'interrupteur et réceptacles de base) ne sont pas interchangeables avec les composants de type B.
- La dimension du trajet de la came des appareils de poussoir pour interrupteurs de position de type C est la même que celle des appareils de type B *non enfichables;* mais 5,6 mm (0,22 po) de moins que celle des appareils de type B *enfichables*. Si cela cause un problème, une plaque intermédiaire 9007 CT10 est disponible.
- Les composants de l'interrupteur de position à position neutre de type C68, CO68, CT68, T5 et T10 **ne** sont interchangeables avec **aucun** autre composant d'interrupteur de position de type C, **incluant** les types C64, CO64, CT64 et BW.
- Les unités enfichables de type CO sont listées UL seulement lorsqu'elles sont utilisées avec les réceptacles de base classe 9007 CT.
- Les interrupteurs de position classe 9007 type C sont conformes avec IEC 60957.5.1, SC 8.3.4 lorsqu'ils sont protégés par un fusible Bussmann CC KTK-R-10.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

Seul un personnel qualifié doit effectuer l'installation, l'utilisation, l'entretien et la maintenance du matériel électrique. Schneider Electric n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation de cette documentation.

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RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 5
Drag Chain

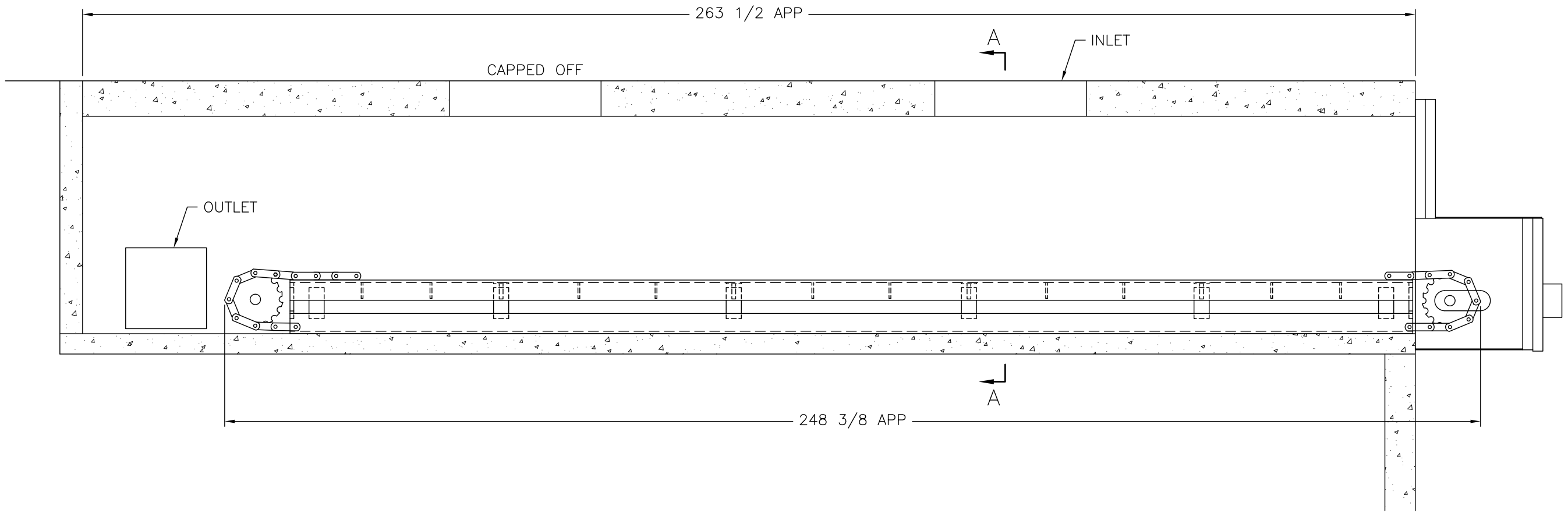
1813 Frank Holt Drive Burlington NC 27215 336-226-1100 rendeq.com

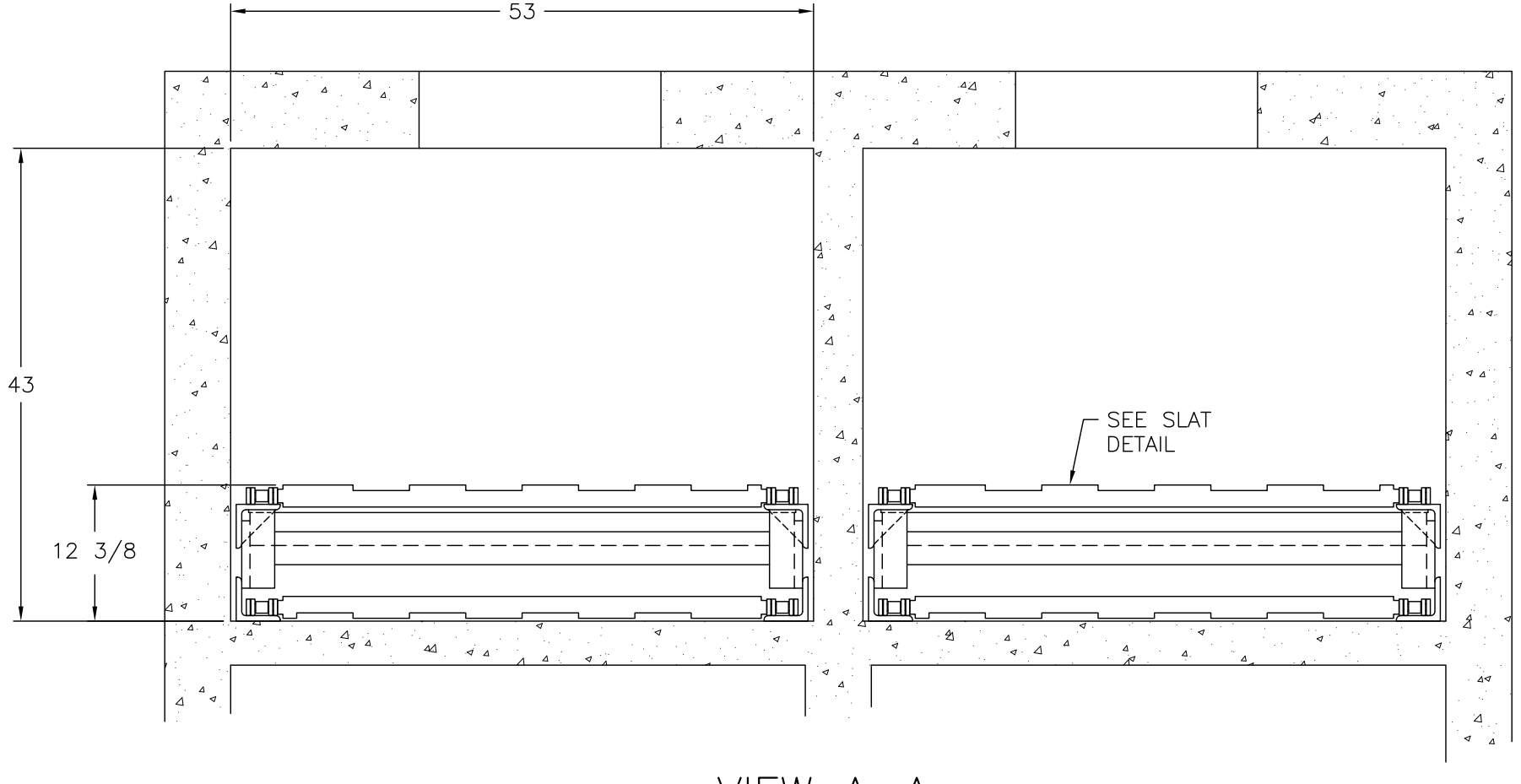
RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

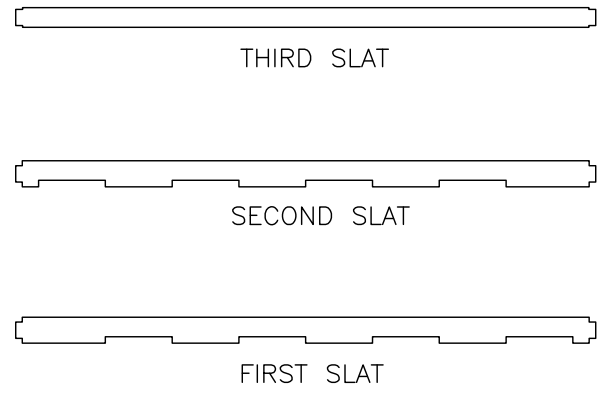
RENDEQ, INC. GTAF System
DRAG CHAIN SYSTEM

Item	Qty	Part Numbers/ Description
Chain	~168ft.	4 runs at 42ft. each
Motors	2	(1) Baldor CWDM3615T, (1)Leeson C184T17FK14D
Gearboxes	2	Conedrive U0-7600C-AL, U0-7700-AL
Sprockets	8	Custom Built
Bearings	4	Dodge P2B-LT10-200
Take-Up Frames	4	(2) Dodge 038211 (2) Custom Built
Take-Up Bearings	4	(2) Dodge 125363 (2) Dodge 125362
Drive Chain	~20ft.	120RIV
Drive Gears	2	B1216
Driven Gears	2	120BTL16H Taper Bush 1-1/2” Pitch 16 Teeth
Belts	4	3VX375
Bushings	4	(2) 2” Bore (2) 1-1/8” Bor
Sheaves	2	Dodge 112194





VIEW A–A



SLAT DETAIL

SLATS SPACED 32"
TO 40" APART

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Phone: (336) 226-1100 or (336) 376-9004
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

SUBJECT CHAIN DRAG SYSTEM
FOR GASIFIER

Washdown Duty Products

BALDOR®

Washdown Motors

The standard in the food and pharmaceutical processing industries for more than 15 years, the Baldor Washdown Duty motors recently raised the bar once again with more features to improve reliability. A new exterior paint process makes the finish coat five times more resistant to corrosion and chipping. Exxon Polyrex® EM grease provides improve lubrication life, provides greater shear stability and superior resistance to washout, rust and corrosion. Distinctive blue colored drain plugs make them easy to recognize; new shape makes themeasy to remove.

Performance Data: TEFC - Totally Enclosed Fan Cooled, TENV - Totally Enclosed Non-Ventilated, 230/460 Volts, Three Phase, 1/2 through 20 Hp

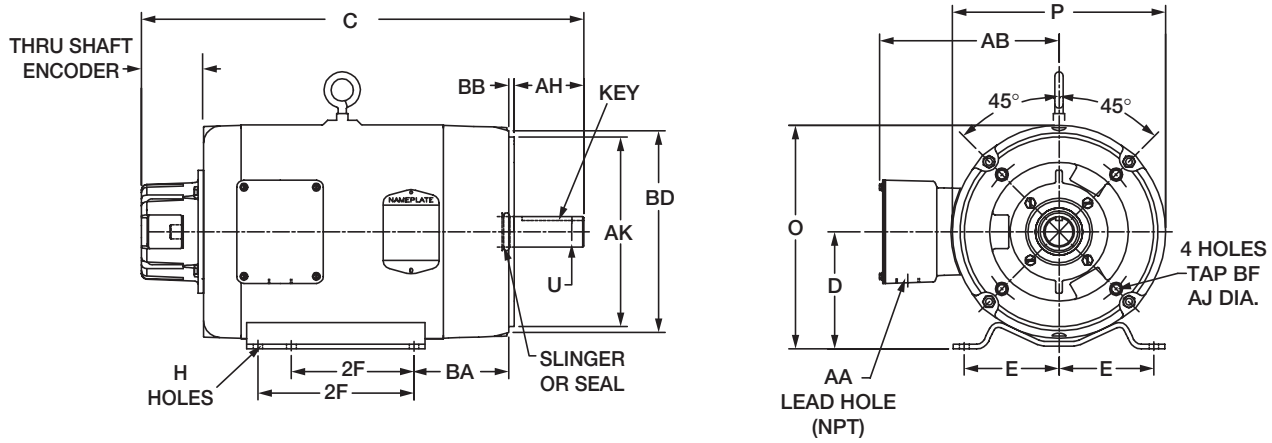
Hp	kW	RPM	Frame	Catalog No.	Amps @ High V		Full Load Torque Lb. Ft.	Efficiency %			Power Factor %			Bearings		Volt Code	"C" Dim.	Conn. Diag. No.
					Full Load	Locked Rotor		1/2	3/4	Full Load	1/2	3/4	Full Load	DE	ODE			
Rigid base																		
0.5	0.37	1725	56	WDM3538 ▮	0.8	6.25	1.5	72.4	76.2	75.5	64	76	83	6205	6203	E1	11.07	CD0005
0.75	0.56	1725	56	WDM3542 ▮	1.1	8.5	2.3	77.9	79.9	80.0	55	71	81	6205	6203	E1	11.07	CD0005
1	0.75	1725	143T	WDM3546T ▮	1.6	11.3	3.0	75.4	79.3	81.5	58	71	74	6205	6203	E	12.12	CD0005
1.5	1.1	1725	145T	WDM3554T ▮	2.1	18.3	4.5	78.0	81.7	82.5	65	72	82	6205	6203	E	13.00	CD0005
2	1.5	1740	145T	WDM3558T ▲	2.8	21.6	6.0	83.6	85.2	84.0	61	74	81	6205	6203	E	14.08	CD0005
3	2.2	1750	182T	WDM3611T ▲	4.1	32.4	8.9	86.1	85.1	87.5	59	71	78	6206	6205	E	16.54	CD0005
5	3.7	1750	184T	WDM3615T ▲	7.1	53.6	12.0	87.0	88.2	87.5	57	69	75	6206	6205	E	16.54	CD0005
7.5	5.6	1760	213T	WDM3710T ▲	9.8	65.2	22.3	88.6	89.8	89.5	63	74	80	6307	6206	E	17.89	CD0005
10	7.5	1760	215T	WDM3714T ▲	14.2	91.2	29.9	89.2	90.2	89.5	63	74	80	6307	6206	E	19.04	CD0005
C-face with base																		
0.5	0.37	3450	56C	CWDM3537 ▮	0.9	6.0	0.75	59.6	66.9	70.0	62	72	76	6205	6203	E	11.07	CD0005
0.5	0.37	1725	56C	CWDM3538 ▮	0.8	6.25	1.5	72.4	76.2	75.5	64	76	83	6205	6203	E1	11.07	CD0005
0.5	0.37	1140	56C	CWDM3539 ▮	1.0	5.6	2.3	71.5	76.4	77.0	44	57	66	6205	6203	E1	12.07	CD0005
0.75	0.56	3450	56C	CWDM3541 ▮	1.1	8.1	1.14	74.4	78.7	80.0	63	73	80	6205	6203	E1	11.07	CD0005
0.75	0.56	1725	56C	CWDM3542 ▮	1.1	8.50	2.3	77.9	79.9	80.0	55	71	81	6205	6203	E1	11.07	CD0005
0.75	0.56	1140	56C	CWDM3543 ▮	1.3	15.1	3.5	74.5	78.0	78.5	50	63	70	6205	6203	E	12.94	CD0005
1	0.75	3450	56C	CWDM3545 ▮	1.3	8.9	1.5	80.5	83.1	82.5	69	82	88	6205	6203	F	11.07	CD0005
1	0.75	1725	56C	CWDM3546 ▮	1.6	11.3	3.0	75.4	79.3	81.5	58	71	74	6205	6203	E	12.07	CD0005
1	0.75	1725	143TC	CWDM3546T ▮	1.6	11.3	3.0	75.4	79.3	81.5	58	71	74	6205	6203	E	12.13	CD0005
1	0.75	1140	56C	CWDM3556 ▲	1.7	8.0	4.5	71.1	74.1	75.5	47	58	69	6205	6203	E	13.24	CD0005
1.5	1.1	3450	56C	CWDM3550 ▲	2.3	16.0	2.3	66.7	72.7	75.5	59	71	76	6205	6203	F	12.24	CD0005
1.5	1.1	1725	145TC	CWDM3554T ▲	2.1	18.3	4.5	78.0	81.7	82.5	65	72	82	6205	6203	E	13.00	CD0005
1.5	1.1	1140	56C	CWDM3557 ▲	2.5	10.6	7.0	77.1	78.4	75.5	54	67	68	6205	6203	F	13.24	CD0005
2	1.5	3450	56HCY	CWDM3555 ▲	2.7	17.5	3.0	78.2	80.3	78.5	80	87	93	6205	6203	E	13.24	CD0005
2	1.5	3450	145TC	CWDM3555T ▲	2.6	24.3	3.0	81.2	83.8	84.0	73	80	88	6205	6203	E	13.30	CD0005
2	1.5	1740	145TC	CWDM3558T ▲	2.8	21.6	6.0	83.6	85.1	84.0	64	74	81	6205	6203	E	14.17	CD0005
3	2.2	3460	145TC	CWDM3559T ▲	3.7	37.5	4.5	82.8	85.1	85.5	78	86	89	6205	6203	E	14.17	CD0005
3	2.2	1750	182TC	CWDM3611T ▲	4.1	32.4	8.9	86.1	87.8	87.5	59	71	78	6206	6205	E	16.54	CD0005
5	3.7	3450	184TC	CWDM3613T ▲	6.0	56.0	7.6	87.8	88.4	87.5	83	89	92	6206	6205	E	16.54	CD0005
5	3.7	1750	184TC	CWDM3615T ▲	7.1	53.6	12.0	87.0	88.3	87.5	57	69	75	6206	6205	E	16.54	CD0005
7.5	5.6	3450	213TC	CWDM3709T ▲	8.7	94.0	11.3	88.4	89.3	88.5	84	91	93	6207	6205	E	18.54	CD0005
7.5	5.6	1760	213TC	CWDM3710T ▲	9.8	65.2	22.2	88.6	89.8	89.5	63	74	80	6307	6206	E	18.65	CD0005
10	7.4	3500	215TC	CWDM3711T ▲	11.5	84.0	15.0	90.6	90.8	89.5	83	88	91	6307	6206	E	18.65	CD0005
10	7.4	1760	215TC	CWDM3714T ▲	13.0	91.2	29.9	89.2	90.2	89.5	63	74	80	6307	6206	E	19.78	CD0005
15	11.1	3450	254TC	CWDM23994T ▲	17.0	152	22.6	91.6	91.9	90.2	85	90	91	6309	6206	E	21.94	CD0005
15	11.1	3450	215TC	CWDM3713T ▲	17.0	152	22.6	91.6	91.9	90.2	85	90	91	6307	6206	E	21.26	CD0005
15	11.1	1760	254TC	CWDM23933T ▲	17.3	115	42.6	90.3	91.5	91	71	81	89	6309	6208	E1	23.57	CD0005
20	15	3525	256TC	CWDM41906T ▲	22.7	188	30.0	89.7	91.1	91	81	88	90	6309	6208	E1	23.57	CD0180
20	15	1760	256TC	CWDM23934T ▲	23.0	164	60.0	91.0	91.9	91.7	85	84	89	6309	6208	E1	23.57	CD0005

NOTE: Volt Code: E = 208-230/460V, 60Hz; E1 = 230/460V, 60Hz, usable at 208V; F = 230/460V, 60 Hz; H = 575V, 60Hz.
See page 38 for Connection Diagrams. Efficiencies shown are nominal.
Data subject to change without notice. Contact Baldor for certified data.

▮ = TENV Enclosure - See page 26 for dimensions.
▲ = TEFC Enclosure - See page 26 for dimensions.

Dimension Drawings

Washdown Inverter and Vector Motors

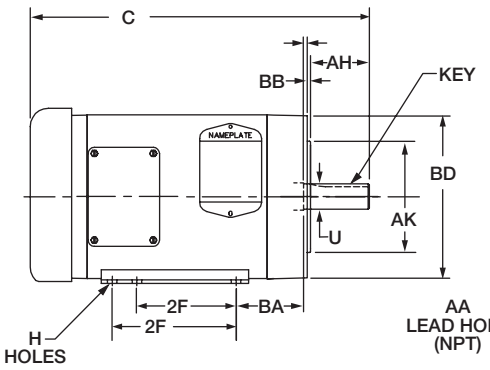


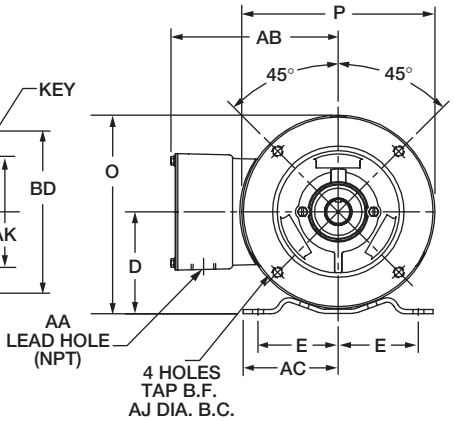
NEMA Frame	Thru Shaft Encoder	D	E	2F	H	AH	O	AB	BA	U	P	BD	AK	AJ	BF TAP	AA	BB
143TC	2.78	3.50	2.75	4.00	0.34	2.12	6.81	5.73	2.75	0.875	6.63	6.51	4.50	5.88	3/8-16	0.50	0.12
145TC				5.00													
182TC	2.78	4.50	3.75	4.50	0.41	2.62	8.44	6.87	3.50	1.125	7.88	8.86	8.50	7.25	1/2-13	0.75	0.25
184TC				5.50													
213TC	2.78	5.25	4.25	5.50	0.41	3.12	10.03	8.05	4.25	1.375	9.56	9.04	8.50	7.25	1/2-13	0.75	0.25
215TC				7.00													
254TC	1.79*	6.25	5.00	8.25	0.53	3.75	12.00	9.72	4.75	1.625	11.69	9.44	8.50	7.25	1/2-13	1.25	0.25
256TC				10.00													

NOTE: * 2.29 for Vector Motor.

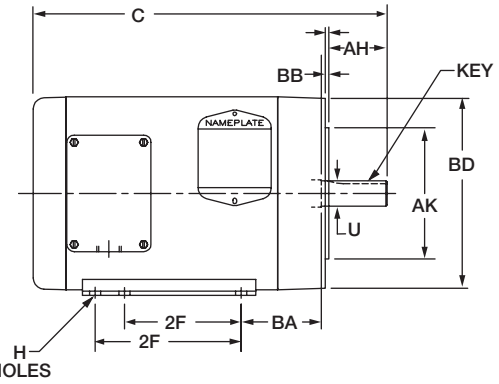
Washdown Inverter

TENV Enclosure





TEFC Enclosure

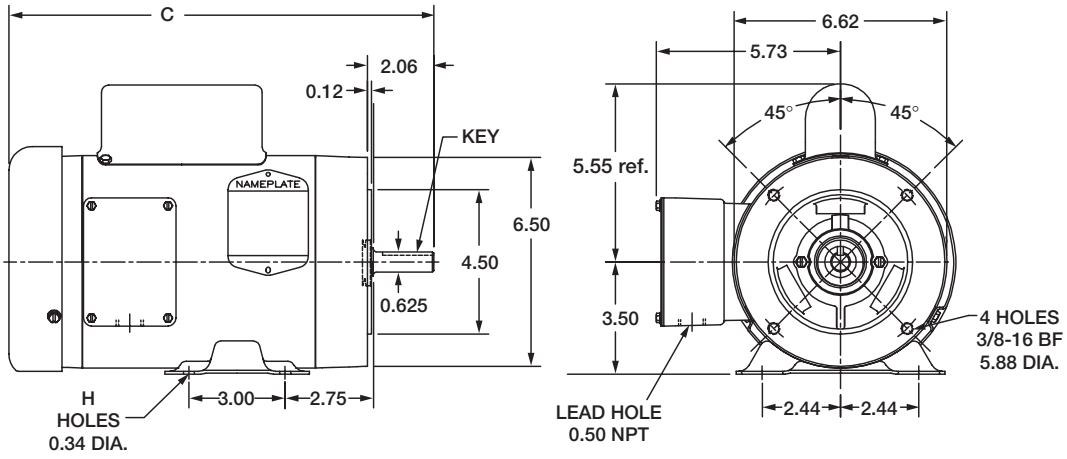


NEMA Frame	D	E	2F	H	AH	O	AB	BA	U	P	BD	AK	AJ	BF TAP	AA	BB
56C	3.50	2.44	3.00	0.34	2.06	6.81	5.73	2.75	0.625	6.62	6.50	4.50	5.88	3/8-16	0.50	0.12
143TC 145TC	3.50	2.75	4.00 5.00	0.38	2.12	6.81	5.73	2.75	0.875	6.62	6.50	4.50	5.88	3/8-16	0.50	0.12
182TC 184TC	4.50	3.75	4.50 5.50	0.41	2.62	9.00	6.56	3.5	1.125	8.50	8.86	8.50	7.25	1/2-13	0.75	0.25
213TC 215TC	5.25	4.25	5.50 7.00	0.41	3.12	10.03	7.46	4.25	1.375	10.18	9.04	8.50	7.25	1/2-13	0.75	0.25

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

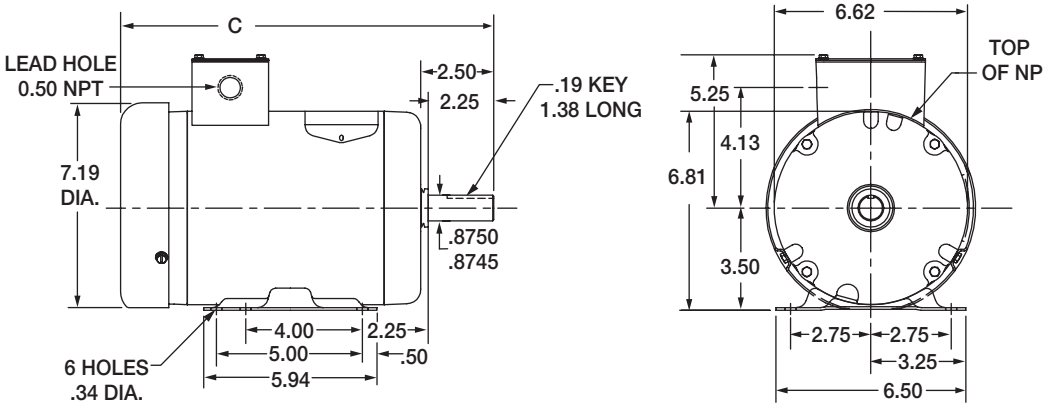
Dimension Drawings

Washdown Single Phase



Catalog No. starting with "C" = C-face with base.
Catalog No. starting with "V" = C-face, no base.

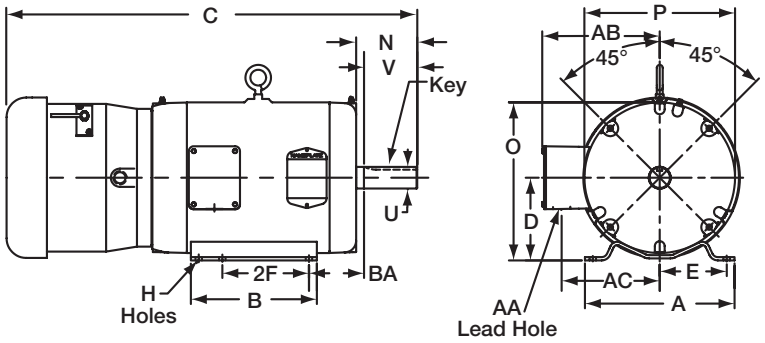
Washdown Feather Picker



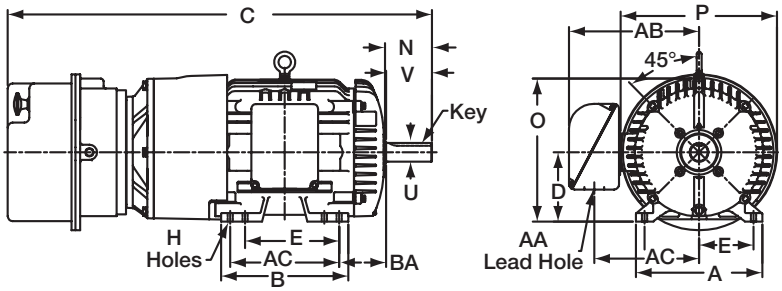
NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

Dimension Drawings

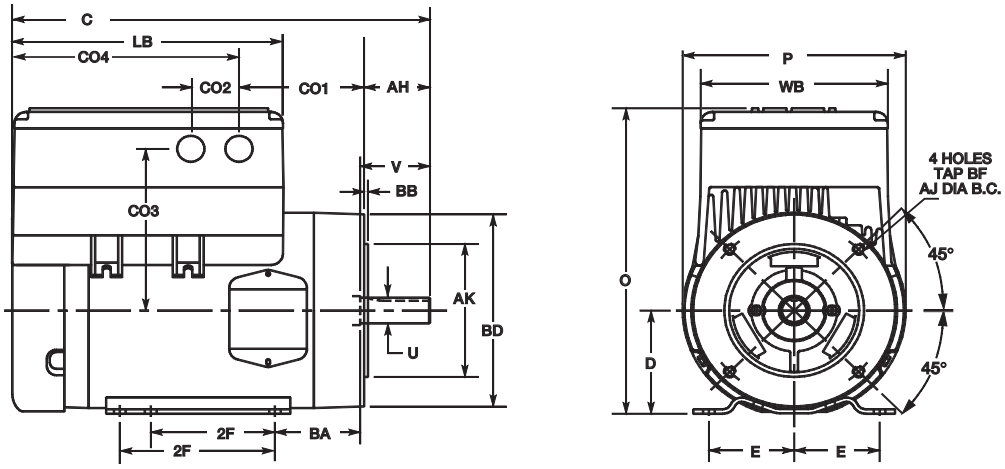
Washdown Super-E



Washdown Super-E Brake Motor



Washdown Baldor SmartMotor®
NEMA 143TC through 215TC



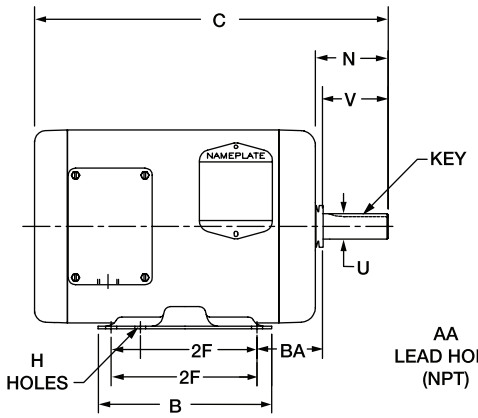
Model	Dimension																			
	2F	D	E	O	P	U	V	AH	AJ	AK	BA	BB	BD	BF	CO1	CO2	CO3	CO4	LB	WB
56C	3.00	3.50	2.44	10.36	7.18	0.6250	1.93	2.06	5.88	4.50	2.75	0.13	6.51	.38-16	4.03	1.38	5.48	7.307	8.73	6.03
143TC	4.00	3.50	2.75	10.35	7.20	0.8750	2.26	2.13	5.88	4.50	2.75	0.13	6.51	.38-16	4.03	1.38	5.48	7.307	8.71	6.03
145TC	5.00	3.50	2.75	10.35	7.20	0.8750	2.26	2.13	5.88	4.50	2.75	0.13	6.51	.38-16	4.03	1.38	5.48	7.307	8.71	6.03
182TC	4.50	4.50	3.75	11.92	8.86	1.125	2.75	2.87	7.25	8.50	3.50	0.25	8.86	.50-13	3.96	1.38	5.58	9.72	11.26	7.12
184TC	5.50	4.50	3.75	11.92	8.86	1.125	2.75	2.87	7.25	8.50	3.50	0.25	8.86	.50-13	5.46	1.38	5.58	9.72	11.26	7.12
213TC	5.50	5.25	4.25	13.69	10.62	1.375	3.37	3.37	7.25	8.50	4.25	0.25	9.04	.50-13	4.79	1.91	7.11	10.58	11.75	8.27
215TC	7.00	5.25	4.25	13.69	10.62	1.375	3.37	3.37	7.25	8.50	4.25	0.25	9.04	.50-13	4.74	1.91	7.11	10.58	11.75	8.27

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

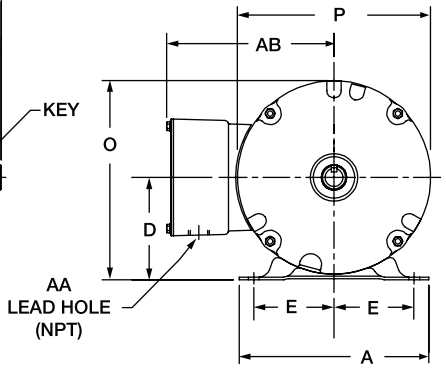
Dimension Drawings

Washdown NEMA 56 through 256TC

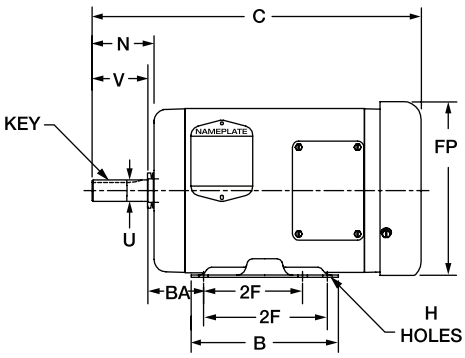
TENV Enclosure



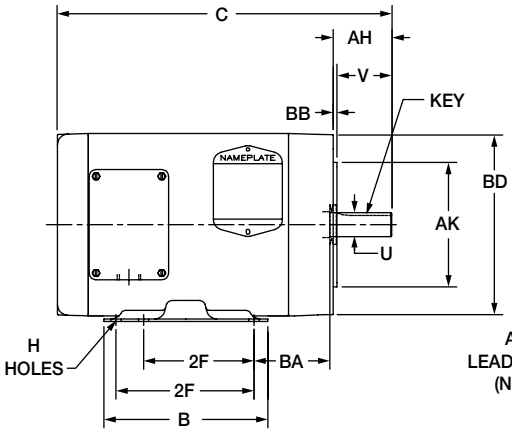
Base Mount



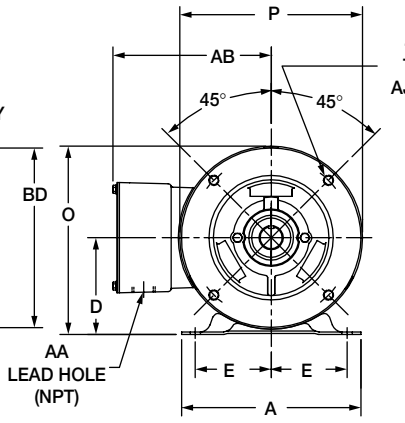
TEFC Enclosure



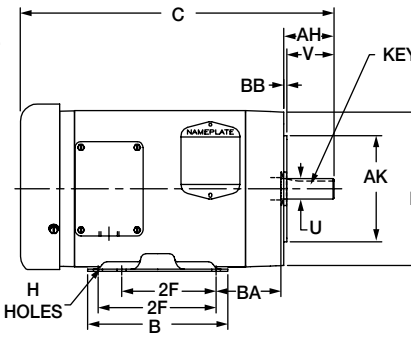
TENV Enclosure



C-face with or without Base



TEFC Enclosure



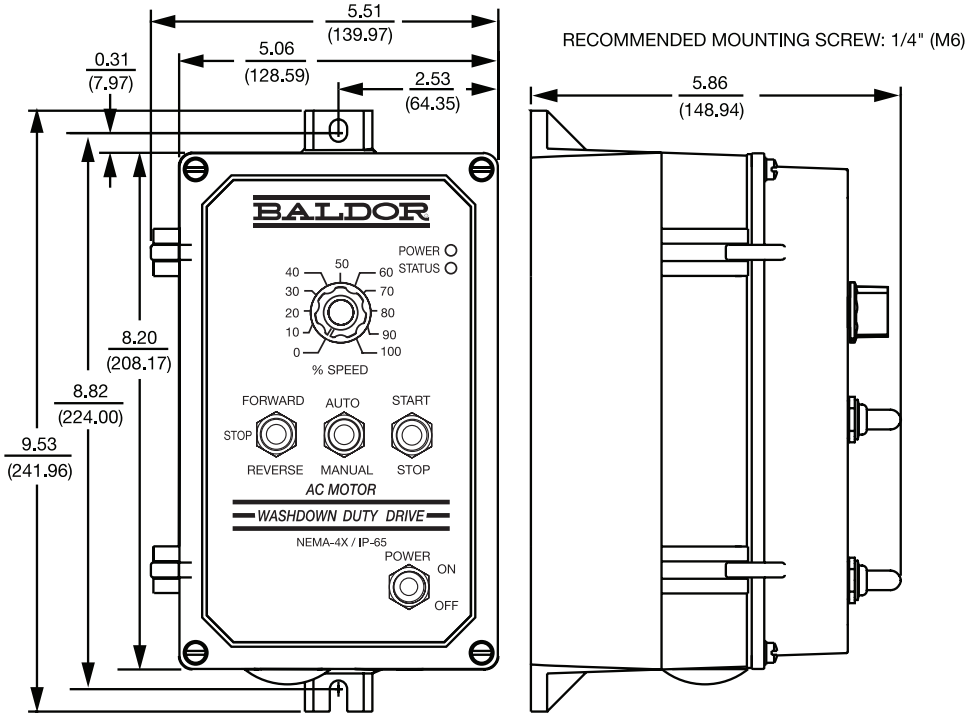
Catalog No. starting with "C" = C-face with base.
Catalog No. starting with "V" = C-face, no base.

NEMA Frame	A	B	D	E	2F	H	N	O	P	U	V	AA	AB	AH	AJ	BF TAP	AK	BA	BB	BD
56	6.50	4.50	3.50	2.44	3.00	0.34	2.44	6.81	6.62	0.625	1.88	0.50	5.22	-	-	3/8-16	-	2.75	-	-
56C	6.50	4.50	3.50	2.44	3.00	0.34	-	6.81	6.62	0.625	1.88	0.50	5.22	2.06	5.88	3/8-16	4.50	2.75	0.12	6.50
143T	6.50	5.94	3.50	2.75	4.00	0.34	2.50	6.81	6.62	0.875	2.25	0.50	5.22	-	-	3/8-16	-	2.25	-	-
143TC	6.50	5.94	3.50	2.75	4.00	0.34	-	6.81	6.62	0.875	2.25	0.50	5.22	2.12	5.88	3/8-16	4.50	2.75	0.12	6.50
145T	6.50	5.94	3.50	2.75	5.00	0.34	2.50	6.81	6.62	0.875	2.25	0.50	5.22	-	-	3/8-16	-	2.25	-	-
145TC	6.50	5.94	3.50	2.75	5.00	0.34	-	6.81	6.62	0.875	2.25	0.50	5.22	2.12	5.88	3/8-16	4.50	2.75	0.12	6.50
182T	8.63	6.50	4.50	3.75	4.50	0.41	3.56	8.44	7.88	1.125	2.75	0.75	5.97	-	-	1/2-13	-	2.75	-	-
182TC	8.63	6.50	4.50	3.75	4.50	0.41	-	8.44	7.88	1.125	2.75	0.75	5.97	2.62	7.25	1/2-13	8.50	3.50	0.25	8.89
184T	8.63	6.50	4.50	3.75	5.50	0.41	3.56	8.44	7.88	1.125	2.75	0.75	5.97	-	-	1/2-13	-	2.75	-	-
184TC	8.63	6.50	4.50	3.75	5.50	0.41	-	8.44	7.88	1.125	2.75	0.75	5.97	2.62	7.25	1/2-13	8.50	3.50	0.25	8.89
213T	9.50	8.00	5.25	4.25	5.50	0.41	3.88	10.03	9.56	1.375	3.37	0.75	7.46	-	-	1/2-13	-	3.50	-	-
213TC	9.50	8.00	5.25	4.25	5.50	0.41	-	10.03	9.56	1.375	3.37	0.75	7.46	3.12	7.25	1/2-13	8.50	4.50	0.25	9.04
215T	9.50	8.00	5.25	4.25	7.00	0.41	3.88	10.03	9.56	1.375	3.37	0.75	7.46	-	-	1/2-13	-	3.50	-	-
215TC	9.50	8.00	5.25	4.25	7.00	0.41	-	10.03	9.56	1.375	3.37	0.75	7.46	3.12	7.25	1/2-13	8.50	4.50	0.25	9.04
254TC	11.25	9.50	6.25	5.00	8.25	0.53	-	12.00	11.50	1.625	4.00	1.25	8.99	3.75	7.25	1/2-13	8.50	4.75	0.25	9.44
256TC	11.25	11.25	6.25	5.00	10.00	0.53	-	12.00	11.50	1.625	4.00	1.25	8.99	3.75	7.25	1/2-13	8.50	4.75	0.25	9.44

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

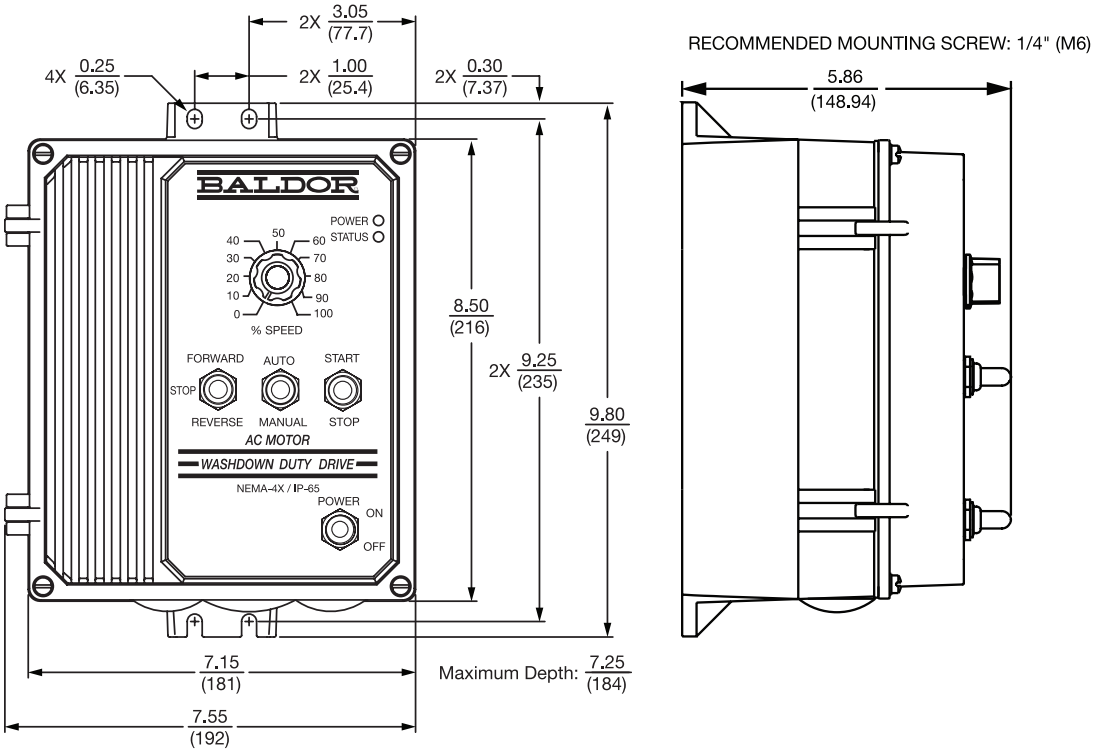
Dimension Drawings Series 5 Micro Inverters

1 Hp



SHOWN WITH OPTIONAL AUTO/MANUAL AND FORWARD-STOP-REVERSE

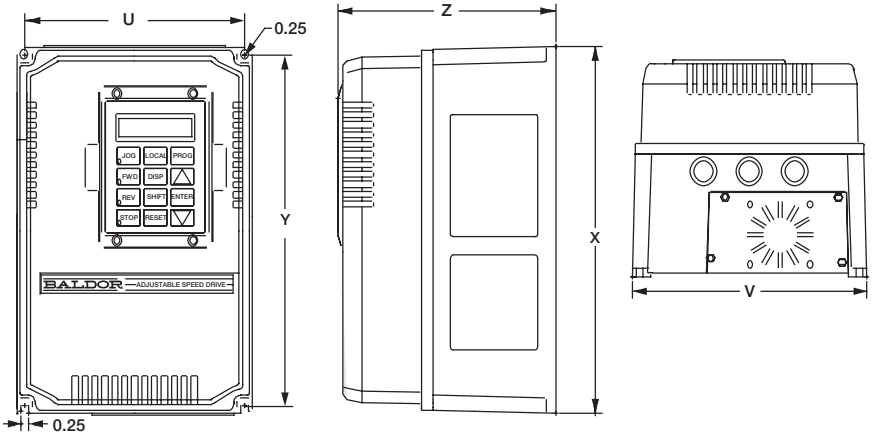
2 thru 5 Hp



NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

Dimension Drawings

Series 15H "General Purpose" Inverter
Series 18H Vector and Series 23H Servo Washdown Controls

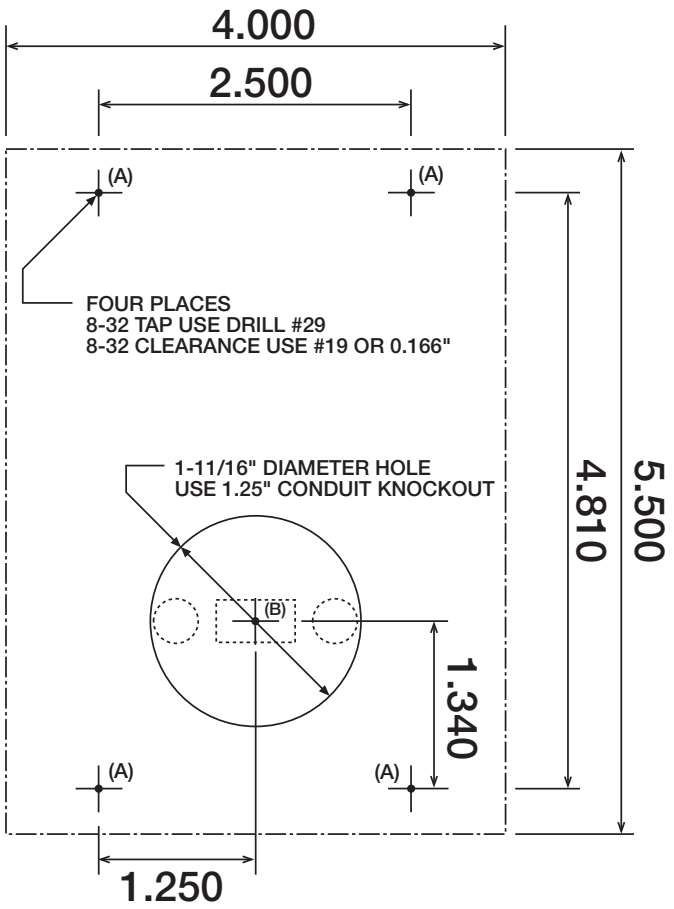


Dimensions in/(mm)

Size	Outside			Mounting		Ap'x
	Height	Width	Depth	Height	Width	Shpg. Wgt.
A	12.272/(312)	7.974/(203)	7.120/(181)	11.5/(292)	7.2/(183)	20
B	15.4/(391)	10/(254)	7.1/(180)	14.6/(371)	9.2/(234)	30

NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

Remote Keypad Mounting for SmartMotor, 15H 18H and 23H

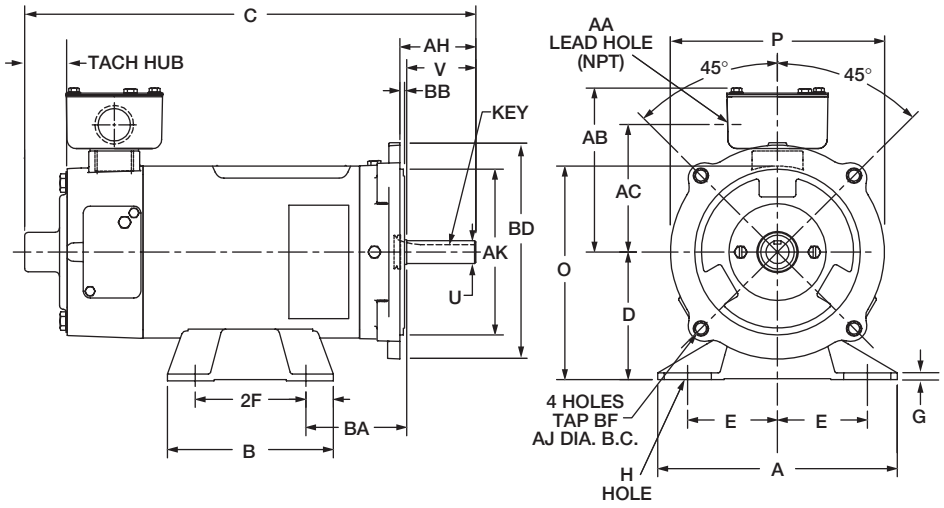


NOTE: Dimension for reference only. Contact a Baldor District Office or www.baldor.com for the detailed dimension drawing for your specific catalog number.

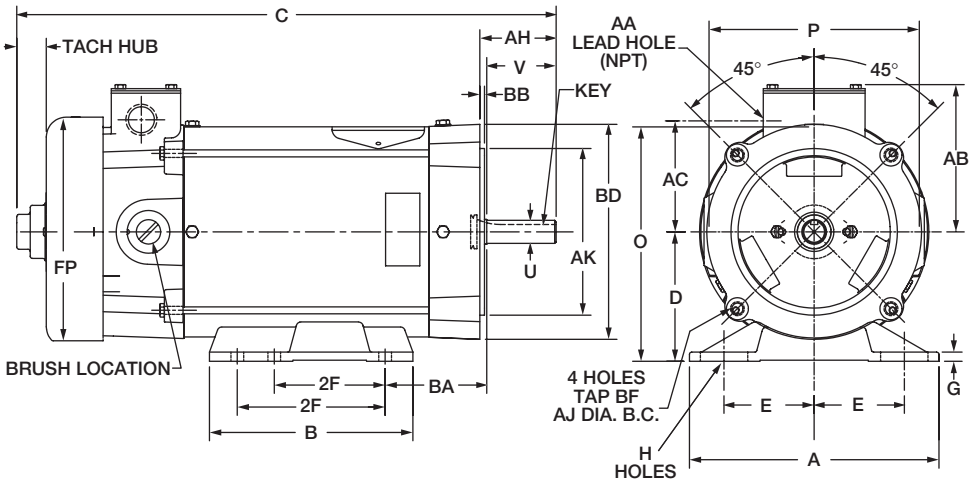
Dimension Drawings

Washdown DC Motors
NEMA 56C through 1810ATC

TENV 56C

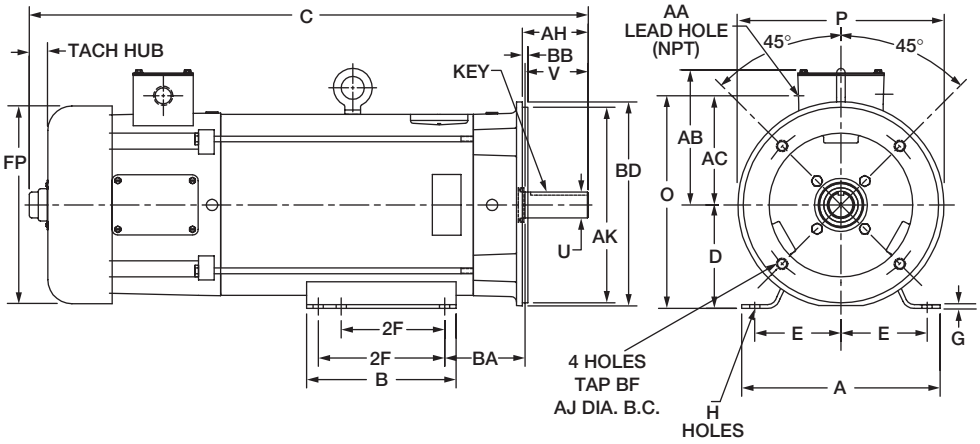


TEFC 56C, 143-5TC



Paint free motors do not have tach adapter and hub extension on fan cover.

TEFC 184TC, 1810 ATC



LEESON ELECTRIC MOTORS, GEARMOTORS AND DRIVES

Product Features

Catalog No 131777.00 **Model** C184K34DC2 A

Product type AC MOTOR **Stock** Stock

Description 5HP..3490RPM.184.DP./208-230V.1PH.60HZ.CONT.NOT.40C.1.15SF.C FACE..C184K34DC2A

Information shown is for current motor's design

Engineering Data

Volts	208-230	Volts		Volts	
F.L. Amps	23-22.2	F.L. Amps		F.L. Amps	
S. F Amps	26.6-25.2	S. F Amps		S. F Amps	
RPM	3600	Hertz	60		
HP	5	Duty	CONTINUOUS	TYPE	KD
KW	3.7				
Frame	184TC	Serv. Factor	1.15	Phase	1
Max Amb	40	Design	L	Code	G
Insul Class	F	Protection	NOT	Therm.Prot.	
Eff 100%	80	Eff 75%		PF	92
UL	Yes	CSA	Yes	Bearing OPE	6205
CC Number	EXEMPT	CE	No	Bearing PE	6206
Load Type		Inverter Type		Speed Range	NONE
Motor Wt.	73 LB	Enclosure	DP	Lubrication	POLYREX EM
Nameplate	081285	Mounting	ROUND	Rotation	SELECTIVE CCW
Assembly	180-016	Shaft Dia.	1 1/8 IN	Ext. Diag.	005018.01
Cust Part No		Outline	035371-1050	Ext. Diag2	
Packaging	B			Winding	K8222
Carton Label	Leeson Gen Purpose			GROUP:	2
Iris		Paint	STANDARD	Test Card	01
Form Factor		RMS Amps		Const Torque Speed Range	
Torque		Peak			
AB Code		Peak@DegC			
Resistance					
Connection					
Rework Status		Rework TYPE			

Hazardous Loc	NONE		Brake Motors
Explosion Proof		Temp Op Code	FORCE
Class		GROUP:	VDC
Class		GROUP:	ADC
			Brake Coil OHMs @25 C

Performance

Torque UOM	LB-FT	Inertia (WK²)	.16 LB-FT^2	
Torque	7.5(Full Load)	19.2(Break Down)	16(Pull Up)	19(Locked Rotor)
CURRENT (amps)	22.2(Full Load)	0(Break Down)	0(Pull Up)	141(Locked Rotor)
Efficiency (%)	0(Full Load)	78.5(75% Load)	75.1(50% Load)	63.2(25% Load)
PowerFactor	(Full Load)	91.3(75% Load)	86.3(50% Load)	73.7(25% Load)

Load Curve Data @60 Hz, 230 Volts, 5 Horsepower

Load	Amps	KW	RPM	Torque	EFF	PF	Rise By Resis	Frame Rise
0.0	6.9	0.492	3597	0.0	0.0	31.0	0.0	-
0.25	9.03	1.526	3574	1.9	63.2	73.7	0.0	-
0.5	12.69	2.52	3552	3.75	75.1	86.3	0.0	-
0.75	17.15	3.606	3529	5.65	78.5	91.3	0.0	-
1.0	22.2	4.68	3501	7.5	80.0	93.0	44.9	-
1.25	27.16	5.885	3470	9.4	78.8	94.1	0.0	-
1.5	33.3	7.205	3433	11.3	76.5	94.1	0.0	-

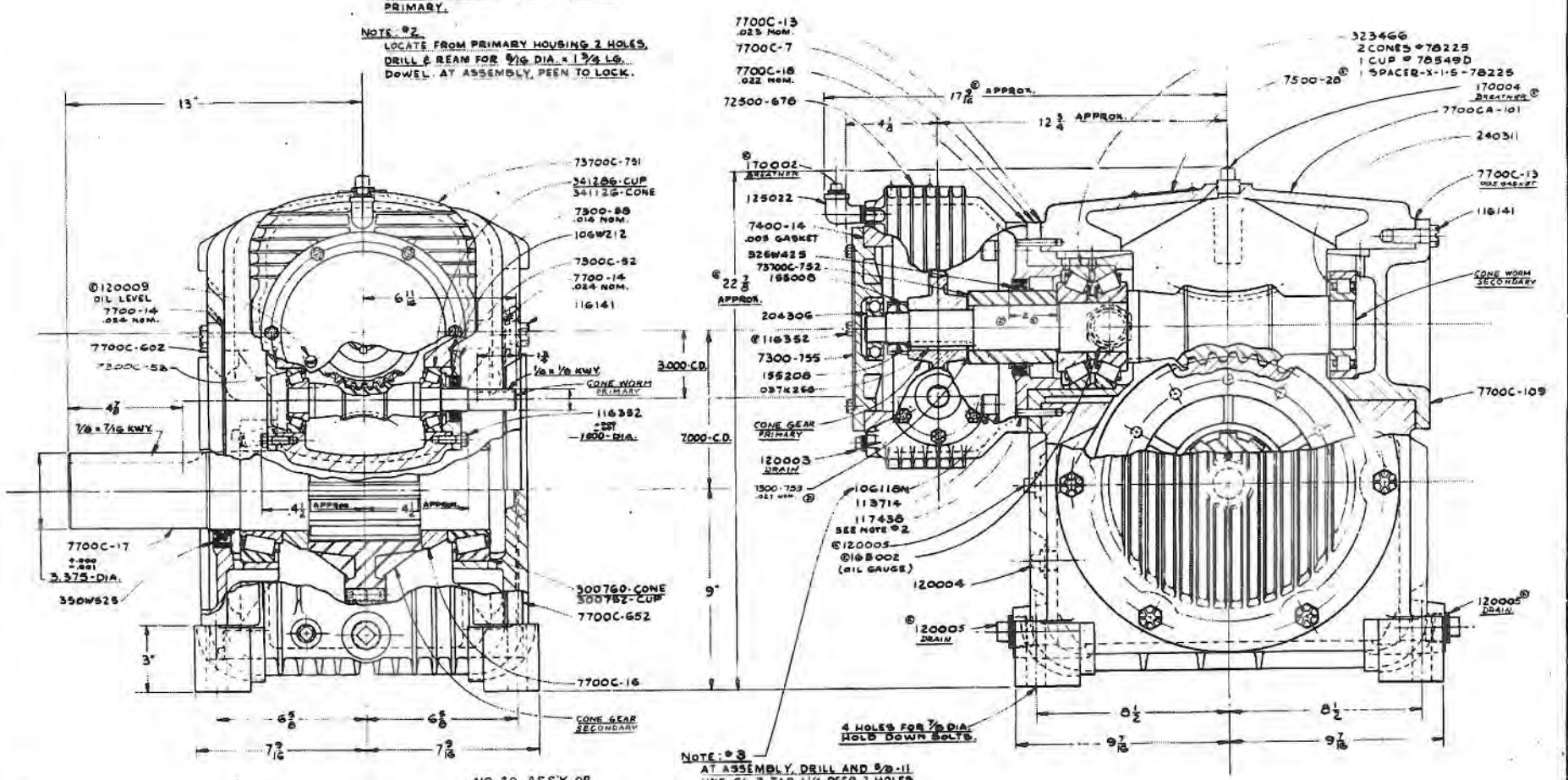
SOURCE: CALCULATED **GROUP:** 2

UO-77000-AL

DO NOT SCALE

NOTE: *1
CENTERLINE OF INPUT SHAFT MUST BE PARALLEL WITH UNIT FEET WITHIN .005 AT ℄ 11/16 FROM CENTERLINE OF PRIMARY.

NOTE: *2
LOCATE FROM PRIMARY HOUSING 2 HOLES, DRILL & REAM FOR 5/16 DIA. x 1 3/4 LG. DOWEL. AT ASSEMBLY, PEEN TO LOCK.

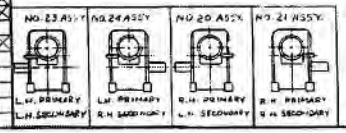


NOTE: *3
AT ASSEMBLY, DRILL AND 5/8-11 UNC CL 3 TAP 1 1/4 DEEP 2 HOLES IN SECONDARY HOUSING. LOCATE FROM PRIMARY HOUSING. DO NOT DRILL THRU.

NO. 20 ASS'Y OR
RIGHT HAND PRIMARY AND LEFT HAND SECONDARY SHOWN

PRINT DISTRIBUTION

	1	2	3	4	5	6	7	8	9	10	11	12
									X			X



LTR	REVISION	AUTHORITY	BY	DATE
E	DRAWN UP TO DATE PER MASTER CH NO. 7554			2-7-51
F	REVISED WITH TAPERED ROLLER BRGS.			12-5-66

TOLERANCE UNLESS OTHERWISE SPECIFIED: FRACTIONAL ±1/64, DECIMAL ±.010, ANGULAR ±1°

MAT. ROUGH WEIGHT 75 LBS. — DRAWN 12-5-66
FINISH WEIGHT — CHECKED
TOOL LAYOUT — APPROVED 12-5-66

CONE-DRIVE GEARS
DIV. OF MICHIGAN TOOL CO. — DETROIT
ENGINEERING DEPT.

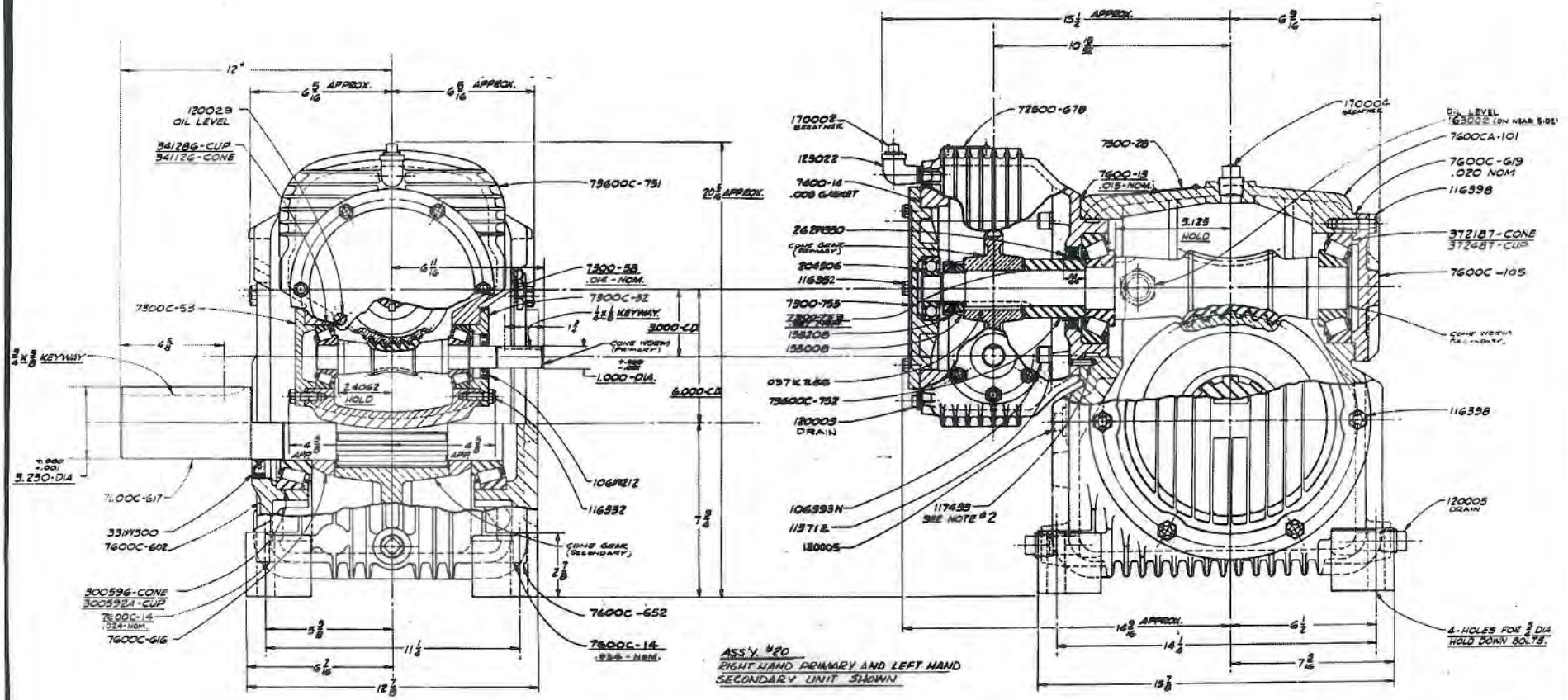
PART NAME: ASSEMBLY-DBL. REDUCTION UNIT
3" C.D. PRIMARY & 7" C.D. SECONDARY
NO. OF SHEETS — PART NO. UO-77000-AL
SHEET NO. 5

UO -7600C-AL

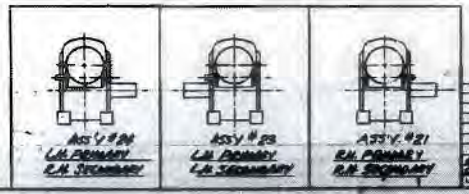
DO NOT SCALE

NOTE: #1
CENTERLINE OF INPUT SHAFT MUST BE PARALLEL WITH UNIT FEET WITHIN .005 AT $6\frac{11}{16}$ FROM CENTERLINE OF PRIMARY.

NOTE: #2
LOCATE FROM PRIMARY HOUSING 2-HOLES, DRILL & REAM FOR $\frac{3}{16}$ DIA. X $\frac{7}{8}$ LG. DOWEL AT ASSEMBLY. PEEN END OF HOLE TO LOCK.



ASS'Y. #20
RIGHT HAND PRIMARY AND LEFT HAND SECONDARY UNIT SHOWN



SCALE - ONE HALF

PRINT DISTRIBUTION											
1	2	3	4	5	6	7	8	9	10	11	12
							XX		X		

CONE-DRIVE GEARS
TIMKEN CO. MICH.
DIV. OF MICHIGAN TOOL CO. - DETROIT
ENGINEERING DEPT.

PART NAME: ASS'Y. CBLE. RED. UNIT - 5-C.D. USING PRIMARY W/ G.C.D. USING SECONDARY

DRAWING NO. UO -7600C-AL

SIZE D

SCALE 1/8

TOLERANCE UNLESS OTHERWISE SPECIFIED

DRAWN JC 1-26-72

TRACED

CHECKED

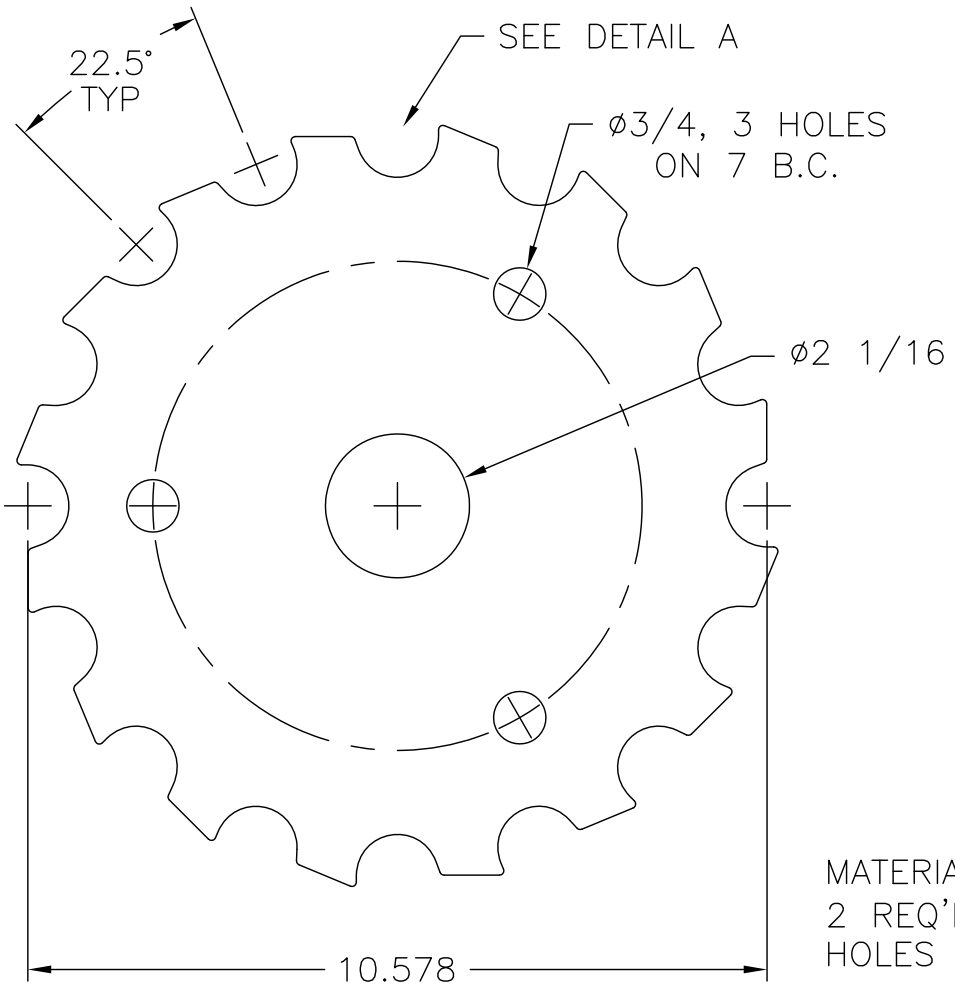
ENGR. APPROVAL

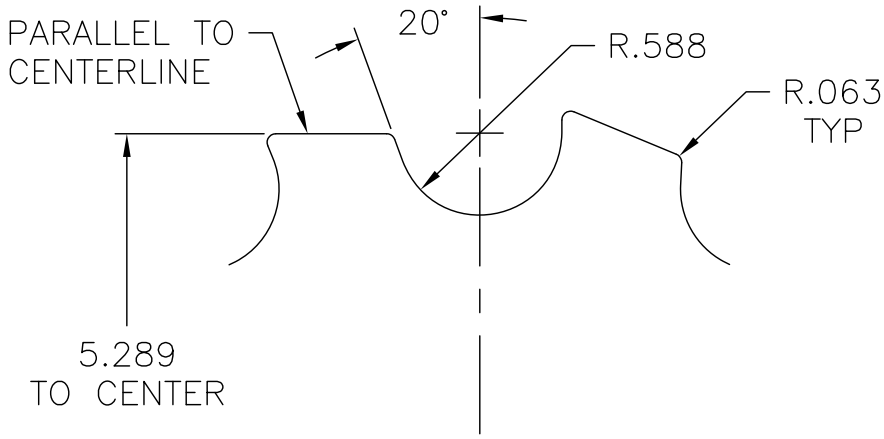
MFG. APPROVAL

TOOL LAYOUT

DATE 1-26-72

REVISION											
LTR.	DESCRIPTION										
A											
B											





DETAIL A

MATERIAL: C.S. PLATE 1/2 THICK,
2 REQ'D PER SPROCKET. ALTERNATE 3/4
HOLES AND PLUG WELD TO EACH OTHER

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

DESIGN _____ DATE _____
DRAWN _____ DATE _____
APPR. BY _____ DATE _____

SUBJECT DRAG CHAIN SPROCKET FOR GASIFIER

JOB NO. _____
SCALE –
DWG. 13409–17 REV 1

Instruction Manual
DODGE® SOLIDLUBE Bearings
700, 1000 and 800 Series

These instructions must be read thoroughly before installation or operation.

INSTALLATION and OPERATION:

Solid Film Lubrication:

Solid film lubricating bearing material will transfer a film or coating of lubricant to the shaft as the shaft rotates. This film or coating prevents metal to metal contact between the shaft and bearing material, as the shaft actually rides upon the lubricant and not upon the bearing itself. Because it is a solid, the lubricant will not squeeze out when the shaft is not rotating, The bearing will not need additional lubrication since the solid lubricant is impregnated into the bushing material and is transferred or "worn" onto the rotating shaft at a rate determined by the rubbing speed of one material to the other and the imposed load. Since this is a "wear type" bushing, wear will be experienced under normal operating conditions.

NOTE: SOLIDLUBE bearings are not designed for rotating housing applications.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a fail safe device must be an integral part of the driven equipment beyond the speed reducer output shaft.

Installation:

Shaft preparation: The bearing journal should not be exposed to grease, oils or dirt to insure good life of the bearing. **NO OIL OR GREASE SHOULD BE USED ON THE BUSHING OR SHAFT WHEN ASSEMBLING THIS BEARING.** The shaft should be clean and free of burrs and nicks. The shaft should be held to a minimum amount of taper and as little eccentricity as possible so a uniformly distributed rubbing surface can be maintained. For best results, the shaft finish should be held to 10 to 20 micro-inches (0.25 to 0.50 micro-meters) and hardness should be 35 Rockwell "C" or higher. Shaft tolerance should be +0.000/-0.002 inches (+0.000/-0.051 millimeters) for commercial steel shafting.

NOTE: The SOLIDLUBE bearing has a high coefficient of friction which can result in stalling when many bearings run off the same drive system. Please contact Baldor Electric Company for further information.

Installation of LT, LTB and LM Pillow Block Assembly:

NOTE: The 1000 Series bushings may have a white film in the bore which should be wiped off with a clean cloth before assembly.

1. Slide the assembled pillow block on the shaft.
2. Align the pillow block on the shaft and tighten the hold-down bolts. Shim the pillow block base, if necessary.

NOTE: Inner unit assemblies are installed properly at the factory. For added service, the bearing inner unit may be rotated 180° while on the shaft to utilize a new bearing surface.

CAUTION: Units should not be rotated 180° with the stop-pin in place as this may restrict self-aligning capabilities.

Installation of MM Pillow Block Assemblies:

1. Loosen the cap bolts being careful not to lose housing shims.
2. Slide the assembled pillow block on the shaft and position for mounting.
3. Insert hold-down bolts but do not tighten.
4. Align the bearing with the shaft using shims when necessary and tighten hold-down bolts.
5. Rotate shaft to allow the inner unit to align itself in the outer housing and tighten the bearing cap bolts.

NOTE: Inner unit assemblies are installed properly at the factory. For added service, the bearing inner unit may be rotated 180º while on the shaft to utilize a new bearing surface.

CAUTION: Units should not be rotated 180º with the stop-pin in place as this may restrict self-aligning capabilities.

Thrust Loads:

Shaft locating collars may be used for slight amounts of thrust loads only. Total collar to bearing clearance should be .010 to .020 inches or .005 to .010 inches per collar.

Running In:

To improve life expectancy from this type of bearing, a brief run-in or break-in can be performed. This may not be possible, but to obtain optimal service, it is advisable to break in this type of bearing. The break-in should be run with a bearing mounted on its mating shaft, as in service, with all possible loading removed. The break-in period will build up the solid film of lubricant on the shaft to reduce potential start-up damage to the bushing.

Shaft Corrosion:

When commercial steel shafting is exposed to corrosive media, the shaft will oxidize, (rust), pit, etc. The SOLIDLUBE bushing is chemically inert but a rusty shaft will grow into the SOLIDLUBE bushing, thus eliminating clearances and restricting movement. Corrective action is to use corrosive resistant shafting such as stainless steel and/or to provide for regularly scheduled movement of the shaft.

Special Operating Conditions:

Consult Baldor Electric Company, Dodge Engineering, Greenville, SC for application assistance, acid, chemical, extreme or other special conditions.

3049-0712

BALDOR
A MEMBER OF THE ABB GROUP

P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895
Dodge Product Support
6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433
www.baldor.com

MN3049 (Replaces 499954 & 499964) 07/12 TCP 25,000

Installation Manual for Bearing Take Up Frame Assemblies

These instructions must be read thoroughly before installation or operation.

INSTALLATION:

1. Make sure that Frame Number on bearing box corresponds with frame that is to be used.
2. Place take-up bearing in open end of frame with inner race facing outward, away from mounting surface. This allows easy locking of bearing to shaft and ample access to the lube fitting after installation.
3. Place adjusting screw thru hole in end of take-up frame and into bearing housing. Line up locking pin hole.
4. Support bearing housing and drive locking pin (packaged with bearing) into bearing housing and thru adjusting screw until pin is flush with housing. Install adjusting nut on other end of adjusting screw.
5. If possible, load should be parallel to take up screw.

WARNING Because of the possible danger to persons(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric Company nor are the responsibility of Baldor Electric Company. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

DODGE®

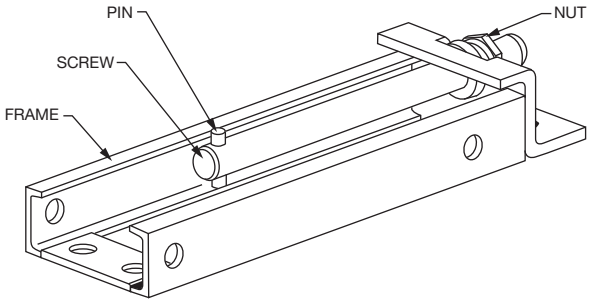


Table 1 - Bearing Take Up Frame Parts				
Assembly Frame	Part Number			
	Frame	Screw	Nut	Pin
210 x 6	039109	130140	130141	409206
308 x 6	039110	406118	130141	409206
308 x 12	038111	406120	130141	409206
400 x 6	039112	406104	036153	409312
400 x 9	039113	406122	036153	409312
400 x 12	038114	406108	036153	409312
400 x 18	038115	406124	036153	409312
407 x 9	039116	130149	036154	409054
407 x 18	039117	130150	036154	409054
415 x 9	039118	130149	036154	409054
415 x 18	039119	130150	036154	409054

MN3044-0314

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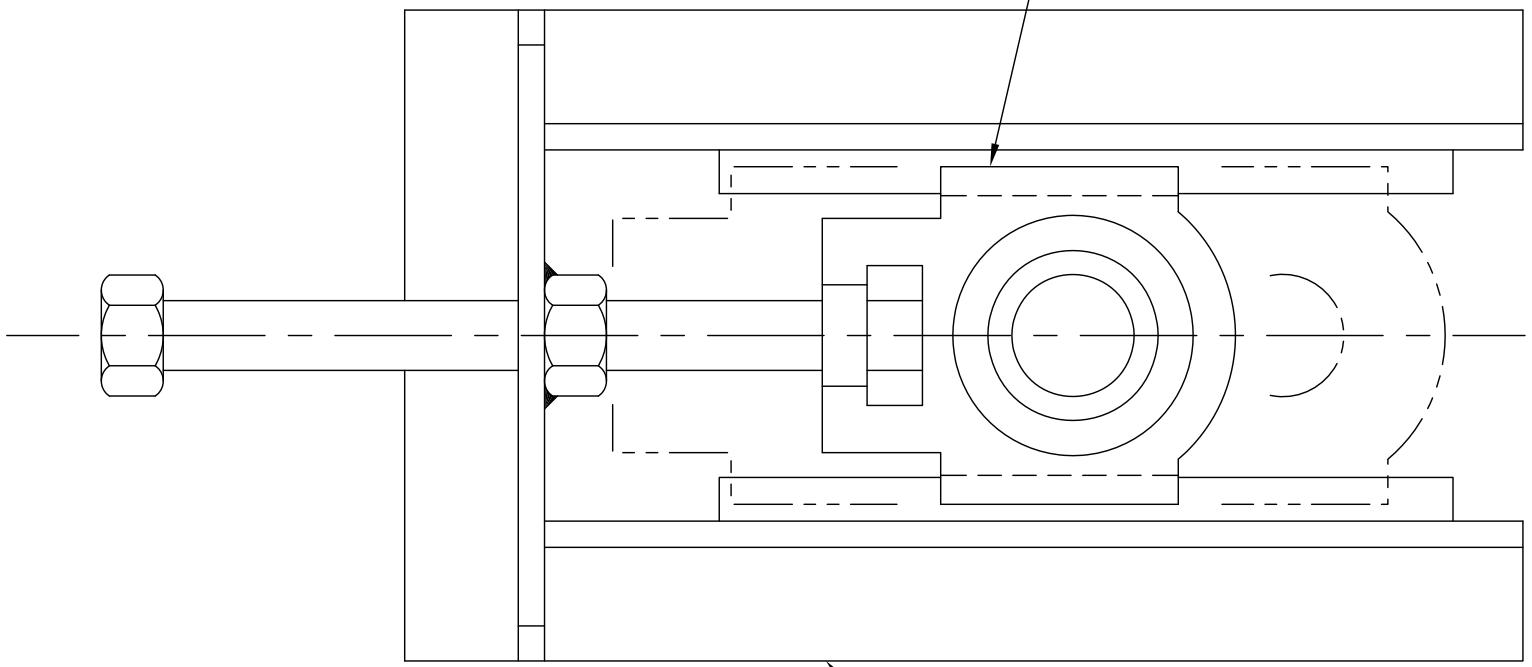
Dodge Product Support

6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433

www.baldor.com

MN3044 (Replaces 499666) 3/14 Litho 35,000

OUTER: STANDARD 2" TAKE-UP BEARING
INNER: STANDARD 1 1/2" TAKE-UP BEARING



OUTER: STANDARD 2" TAKE-UP
FRAME WITH 6" TRAVEL
INNER: FABRICATED LOW PROFILE
FRAME WITH 6" TRAVEL

BEARINGS LOCATED ON
END COVER EXTENSIONS

RENDEQ, Inc.
1813 Frank S. Holt Dr., Burlington, NC 27215
Phone: (336) 226-1100 or (336) 376-9004
Fax: (336)-270-5357
E-mail: rendeq@bellsouth.net or chip@rendeq.com
Web Site: www.rendeq.com

SUBJECT

DRAG CHAIN TAKE-UP BEARINGS

Instruction Manual
DODGE® SOLIDLUBE Bearings
700, 1000 and 800 Series

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2. Align the pillow block on the shaft and tighten the hold-down bolts. Shim the pillow block base, if necessary.

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CAUTION: Units should not be rotated 180° with the stop-pin in place as this may restrict self-aligning capabilities.

Installation of MM Pillow Block Assemblies:

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3049-0712

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A MEMBER OF THE ABB GROUP

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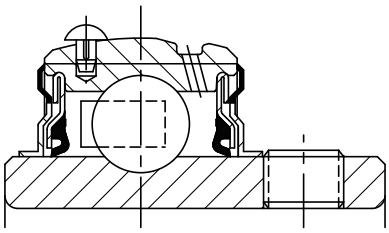
www.baldor.com

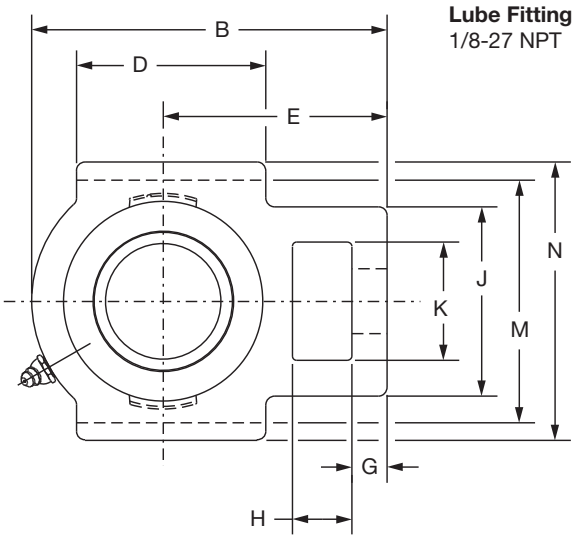
MN3049 (Replaces 499954 & 499964) 07/12 TCP 25,000

SELECTION/DIMENSIONS

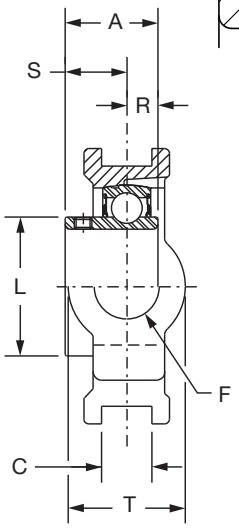
DODGE®

Setscrew Ball Bearings
SC NORMAL DUTY WIDE SLOT TAKE-UP BEARINGS





Lube Fitting Thread Size:
1/8-27 NPT

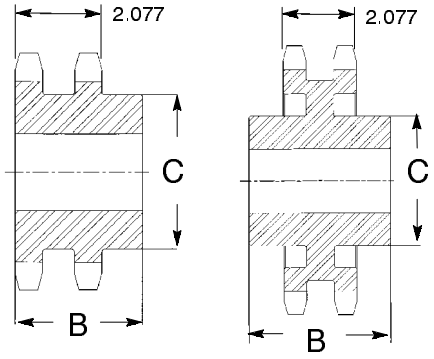


Series	Shaft Size	Standard		No Lube/Sealed for Life (-NL)	
		Part No.	Description	Part No.	Description
	1-5/8	**125151**	WSTU-SC-110L	@	WSTU-SC-110L-NL
	1-11/16	**125115**	WSTU-SC-111	@	WSTU-SC-111-NL
209	1-3/4	**125362**	WSTU-SC-112	@	WSTU-SC-112-NL
	1-13/16	**125121**	WSTU-SC-113	@	WSTU-SC-113-NL
	45mm	***125915***	*WSTU-SC-45M*	@	*WSTU-SC-45M-NL*
	1-15/16	**125116**	WSTU-SC-115	**125071**	WSTU-SC-115-NL
210	2	**125363**	WSTU-SC-200	**062691**	WSTU-SC-200-NL
	50mm	***125916***	*WSTU-SC-50M*	***068374***	*WSTU-SC-50M-NL*
	2	**135183**	WSTU-SCM-200	**058705**	WSTU-SCM-200-NL
211	2-3/16	**125117**	WSTU-SC-203	@	WSTU-SC-203-NL
	2-1/4	**125364**	WSTU-SC-204	@	WSTU-SC-204-NL
	55mm	***125917***	*WSTU-SC-55M*	@	*WSTU-SC-55M-NL*
	2-1/4	**135184**	WSTU-SCM-204	@	WSTU-SCM-204-NL
212	2-7/16	**125118**	WSTU-SC-207	@	WSTU-SC-207-NL
	60mm	***125918***	*WSTU-SC-60M*	@	*WSTU-SC-60M-NL*
	2-1/2	**135185**	WSTU-SCM-208	@	WSTU-SCM-208-NL
214	2-11/16	**064704**	WSTU-SC-211	@	WSTU-SC-211-NL
	70mm	***062975***	*WSTU-SC-70M*	@	*WSTU-SC-70M-NL*
215	2-15/16	**125119**	WSTU-SC-215	@	WSTU-SC-215-NL
	75mm	***125919***	WSTU-SC-75M	@	WSTU-SC-75M-NL

@ Assembled to order

DODGE®

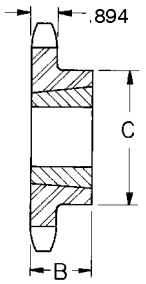
No. 100-2 for 1-1/4″ Pitch Double Strand Chain



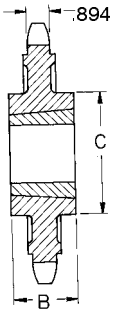
REBORABLE—TYPE B & C									
No. Teeth	Type	Spkt. O.D.	Descr. ★	Part No.	Wt.	Bore		B	C Hub Dia.
						Stock	Max.		
9	B	4.180	D100B9	**101245**	4.6	1	1-1/2	2.87	2.31
10	B	4.600	D100B10	**101246**	6.2	1	1-3/4	2.87	2.69
11	B	5.010	D100B11	**101247**	7.9	1	2-1/8	2.87	3.13
12	B	5.420	D100B12	**101248**	9.3	1-1/8	2-1/4	2.87	3.38
13	B	5.820	D100B13	**101249**	11.4	1-1/8	2-1/2	2.87	3.75
14	B	6.230	D100B14	**101250**	13.6	1-1/8	2-3/4	2.87	4.19
15	B	6.630	D100B15	**101251**	17.1	1-1/4	3-1/8	3.13	4.56
16	B	7.030	D100B16	**101252**	20.1	1-1/4	3-5/16	3.13	5.00
17	B	7.440	D100B17	**101253**	23.1	1-1/4	3-1/2	3.13	5.25
18	B	7.840	D100B18	**101254**	25.4	1-1/4	3-1/2	3.13	5.25
19	B	8.240	D100B19	**101255**	29.6	1-1/4	3-1/4	3.13	5.50
20	B	8.640	D100B20	**101256**	32.4	1-1/4	3-1/4	3.13	5.50
21	B	9.040	D100B21	**101257**	35.3	1-1/4	3-3/4	3.38	5.50
22	B	9.440	D100B22	**101258**	38.4	1-1/4	3-3/4	3.38	5.50
23	B	9.840	D100B23	**101259**	41.3	1-1/4	3-3/4	3.38	5.50
24	B	10.250	D100B24	**101260**	45.1	1-1/4	3-3/4	3.38	5.50
25	B	10.650	D100B25	**101261**	48.5	1-1/4	3-3/4	3.38	5.50
26	B	11.050	D100B26	**101262**	51.5	1-1/4	3-3/4	3.38	5.50
30	B	12.640	D100B30	**101263**	65.0	1-1/4	3-3/4	3.38	5.50
45	C	18.630	D100C45	**101265**	103	1-5/8	4	4.50	6.00
60	C	24.600	D100C60	**101266**	175	2	5	5.00	7.50
80	C	32.570	D100C80	**101268**	231	2	5	5.00	7.50

Maximum Bores shown will accommodate Standard Keyseat and Setscrew over Keyseat. Slightly larger Bores are possible with no Ks., Shallow Ks., or S.S. at angle to Ks.

No. 120 for 1-1/2″ Pitch Single Strand Chain



TYPE BTL



TYPE CTL

TAPER-LOCK								
No. of Teeth	Spkt. O.D.	Description ★	Part No.	Spkt. Wt. w/o Bush.	C Hub Dia.	Bore Range		B
						Min.	Max.	
12	6.498	120BTL12H-2012	**100396**	8.0	3.56	1/2	2-1/8	1.25
13	6.989	120BTL13H-2517	**100644**	6.4	4.25	1/2	2-11/16	1.75
14	7.472	120BTL14H-2517	**100645**	7.8				
15	7.956	120BTL15H-2517	**100646**	9.6				
16	8.441	120BTL16H-3020	**100647**	10.2	5.25	7/8	3-1/4	2.00
17	8.924	120BTL17H-3020	**100648**	11.6				
18	9.407	120BTL18H-3020	**100649**	13.2				
19	9.890	120BTL19H-3020	**100650**	11.2				
20	10.371	120BTL20H-3020	**100397**	16				
21	10.853	120BTL21H-3020	**100651**	18				
22	11.333	120BTL22H-3020	**104761**	26				
23	11.814	120BTL23H-3020	**104762**	28				
24	12.294	120BTL24H-3020	**100398**	24				
25	12.774	120BTL25H-3020	**104763**	32				
26	13.254	120BTL26-3020	**100652**	30				
28	14.213	120BTL28-3020	**104764**	41				
30	15.171	120BTL30-3020	**100399**	39.7				
32	16.130	120BTL32-3020	**100400**	38				
35	17.567	120BTL35-3020	**100232**	46				
36	18.045	120BTL36-3020	**100401**	75				
45	22.352	120CTL45-3535	**104765**	110	6.5	1-3/16	3-15/16	3.50
60	29.522	120CTL60-3535	**100236**	120				
70	34.301	120CTL70-3535	**100238**	144				
80	39.078	120CTL80-3535	**100240**	164				

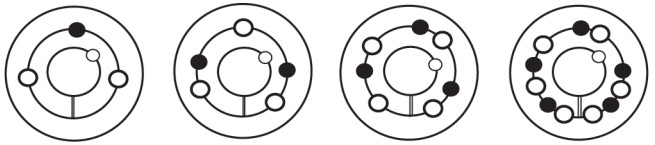
★ "H" suffix indicates Hardened Teeth.

TAPER-LOCK® Bushings

These instructions must be read thoroughly before installation or operation.

WARNING: To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

INSTALLATION:



1. Clean shaft, bore of bushing, outside of bushing and hub bore of all oil, paint and dirt. File away burrs.
2. Insert bushing into hub. Match the hole pattern, not threaded holes (each complete hole will be threaded on one side only).
3. "LIGHTLY" oil setscrews and thread into those half-threaded holes indicated by ○ on above diagram.

   CAUTION: Do not lubricate the bushing taper, bushing bore, hub taper or the shaft. Doing so could result in breakage of the product.

4. Position assembly onto shaft allowing for the small axial movement which will occur during lightening procedure.
5. Alternately torque setscrews to recommended torque setting in chart below.

   CAUTION: Do not use worn hex key wrenches. Doing so may result in a loose assembly or may damage screws.

6. To increase gripping force, lightly hammer face of bushing using drift or sleeve. (Do not hit bushing directly with hammer.)
7. Re-torque screws after hammering.

   CAUTION: Where bushing is used with lubricated products such as chain, gear or grid couplings be sure to seal all pathways (where lubrication could leak) with RTV or similar material.

8. Recheck screw torques after initial run-in, and periodically thereafter. Repeat steps 5, 6 and 7 if loose.

WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation, maintenance and operation procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Baldor Electric nor are the responsibility of Baldor Electric. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a holding device must be an integral part of the driven equipment beyond the speed reducer output shaft.

DODGE®

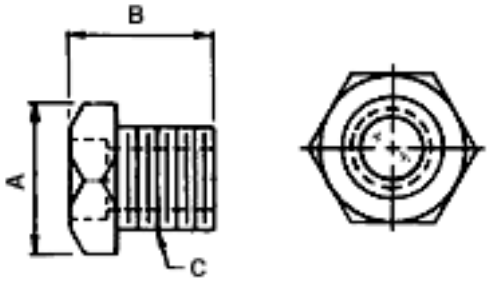
RENDEQ

Equipment, Service & Engineering
for the Animal Protein & Recycling Industries

RENDEQ, INC.
GTAF System

Section 6
Misc.

1813 Frank Holt Drive Burlington NC 27215 336-226-1100 rendeq.com



HI-TEMP PEEP SIGHTS

The quartz lens is suited for a maximum intermittent operating temperature of 2048°F and continuous operating temperature of 1600°F, and allows for optical pyrometer checking of the flame or operation of vessel.
The lens can easily be removed for cleaning or replacement..

Operating environment and temperature should be considered when ordering.

Peep Sights						
Pipe Size	**Viewing Area**	**A**	**B**	**C**	**Unpacked Weight**	**Part Number**
1/2"	1/2"	1-1/4"	1-15/32"	1/2" NPT	1/2#	1/2PS
3/4"	3/4"	1-1/2"	1-1/2"	3/4" NPT	1/2#	3/4PS
1"	1"	1-3/4"	1-11/16"	1" NPT	1/2#	1PS
1-1/4"	1-1/4"	2"	1-23/32"	1-1/4" NPT	1#	1-1/4PS
1-1/2"	1-1/2"	2-1/4"	1-23/32"	1-1/2" NPT	1#	1-1/2PS
2"	2"	2-3/4"	1-3/4"	2" NPT	1#	2PS

Glass Options				
Type	**Thickness**	**Maximum Intermittent Temperature**	**Maximum Continuous Temperature**	**Code Letter**
Quartz Clear	1/4"	2048 ° F / 1120 ° C	1600 ° F / 871 ° C	Q