Odyssey Operations Manual

hycomp

CONTENTS

WARRANTY - GENERAL

Hycomp warrants that its boosters will be free from defects in material and workmanship for a period of twelve (12) months from the date of purchase.

Hycomp boosters which fail within the 12 month period due to defects in material or workmanship will be repaired or replaced at Hycomp's discretion provided the Purchaser meets all of the applicable requirements of the warranty and none of the limitations apply.

Any parts subject to wear or abuse are not covered by this limited warranty. These may include, but are not limited to, mechanical seals, bearings, piston rings, valves, packings, and other parts showing signs of abuse.

This limited warranty is void if any product or accessory has been serviced or altered by anyone not authorized by Hycomp.

Additional warranty limitations apply. Please see complete warranty policy for details.

NOTICE TO HYCOMP CUSTOMERS

Hycomp recommends you order service and replacement parts according to the model number and serial number found on the nameplate of your booster. Do not order parts from the general descriptions in this manual. Ordering directly from Hycomp or a registered vendor will minimize the possibility of receiving incorrect parts for your booster.

BOOSTER NAMEPLATES

Each Hycomp model has a nameplate attached to the crosshead guide cylinder, usually on the oil-pump end. The information on this nameplate should be available when ordering parts for the booster or requesting assistance with troubleshooting, maintenance, installation, or operation.

Before contacting Hycomp, note who you purchased the booster from, who installed it, the installation date, the purchase date, and the model number. This will help Hycomp identify your booster and any special parts and materials that may have been used. Fill in the information from the new booster into the spaces provided in the sample nameplate below.

Installed By _____

Installation Date_____

Purchased Date_____

Purchased From _____

Date of Startup_____

Model #_____

Serial #_____

GENERAL INFORMATION

NOTICE: Hycomp boosters must only be installed in systems which have been designed by qualified personnel. The system MUST conform to all applicable federal, state, local, and national standards. Please reference the Odyssey Installation Manual for further details.

This manual is intended to assist qualified technical personnel in the operation and maintenance of Hycomp boosters and should be kept with the booster at all times.

Hycomp boosters shall only be serviced and maintained by qualified personnel. Routine inspection and maintenance is highly recommended.

SAFETY

Hycomp ensures, from the beginning, that safety is designed into every booster. A booster is a precision, high speed, mechanical piece of equipment. They require caution in operation to minimize hazard to one's self and property. The following is a list of safety precautions that should always be observed:

1. Do not try to service any part of the booster or accessory while the unit is operating.

2. The main power disconnect switch must be turned off; lockout/tagout the switch before performing any work or maintenance on the unit per OSHA Regulation 1910.147.

3. Relieve the system of all pressure before attempting to service any part of the unit per OSHA Regulation 1910.147.

4. The unit must not be operated with any of its safety guards, shields, or screens removed.

5. Do not remove any warning signs or the manufacturer's nameplate.

6. Frequently check pressure relief valves for proper operation.

7. Any changes to the booster operating parameters should only be made with the approval of Hycomp. Contact the factory should a change be necessary.

Depending upon the model of the booster and the style of the gas packing, intake pressures may range up to 100 psig, while discharge pressures may vary up to 600 psig. Pressures above 600 psig are possible with customized units.

Most Hycomp boosters are sized for specific applications; therefore, it is essential to contact the factory before changing running conditions of the booster.

ALL INDUSTRIAL GASES WILL PROVE FATAL TO PERSONNEL EXPOSED. Some gases are immediately toxic or corrosive and may cause short or long term damage or death to personnel that are exposed to the gas. Only air is capable of supporting life. Gases that are generally inert to humans (Nitrogen, Helium, Argon, etc.) will not sustain life if personnel are exposed to a pure gaseous atmosphere.

Because there is NO SAFE GAS OTHER THAN AIR, it is imperative that all exposure to industrial gases be closely monitored and regulated. Federal mandate requires specific procedures must be established for any company that deals with industrial gases. This includes, but may not be limited to, gas containment policy, protection required for personnel working with the gas, availability of SDS's, specific training, emergency spill and/or contact procedures, etc. Always check if there are EPA or OSHA standards that may apply.

Ensure all materials used in the booster and associated plumbing, including coolers, separators, filters, receivers, regulators, piping, etc., are compatible with the process gas being compressed. If unsure, contact the manufacturer of the equipment.

INTRODUCTION TO ODYSSEY BOOSTERS

Hycomp Odyssey oil-free boosters are unique in the industry due to their small size, open crosshead, and gas packing design. The open crosshead allows any oil vapors that may escape from the crankcase to be vented to the atmosphere, thereby preventing their entrainment in the compressed gas stream. Hycomp's innovative use of the incoming gas stream to help cool gas packings provides extended performance benefits and service life.

These boosters draw process gas from a source that is already at elevated pressure and "boost" it to an even higher pressure. Because these boosters do not draw from atmosphere, they require special attention to inlet gas conditions and cleanliness.

Hycomp's gas packing design minimizes leakage of gas vapors to the open atmosphere. Hycomp utilizes self adjusting, segmented packings to seal against the piston rod and safely contain the gas. This gas can then be vented to a safe location, or a variety of purging, venting, or padding options may be used to control the gas leakage.

Hycomp Odyssey boosters are specialized and engineered specifically for each application, making them different from other types of boosters offered in the market. They are available in single and two stage models.

All Hycomp compressors and boosters are tested at the factory to ensure they meet contractual requirements. When properly installed, the booster should be ready and able to provide the reliable service that Hycomp customers have come to trust and appreciate.

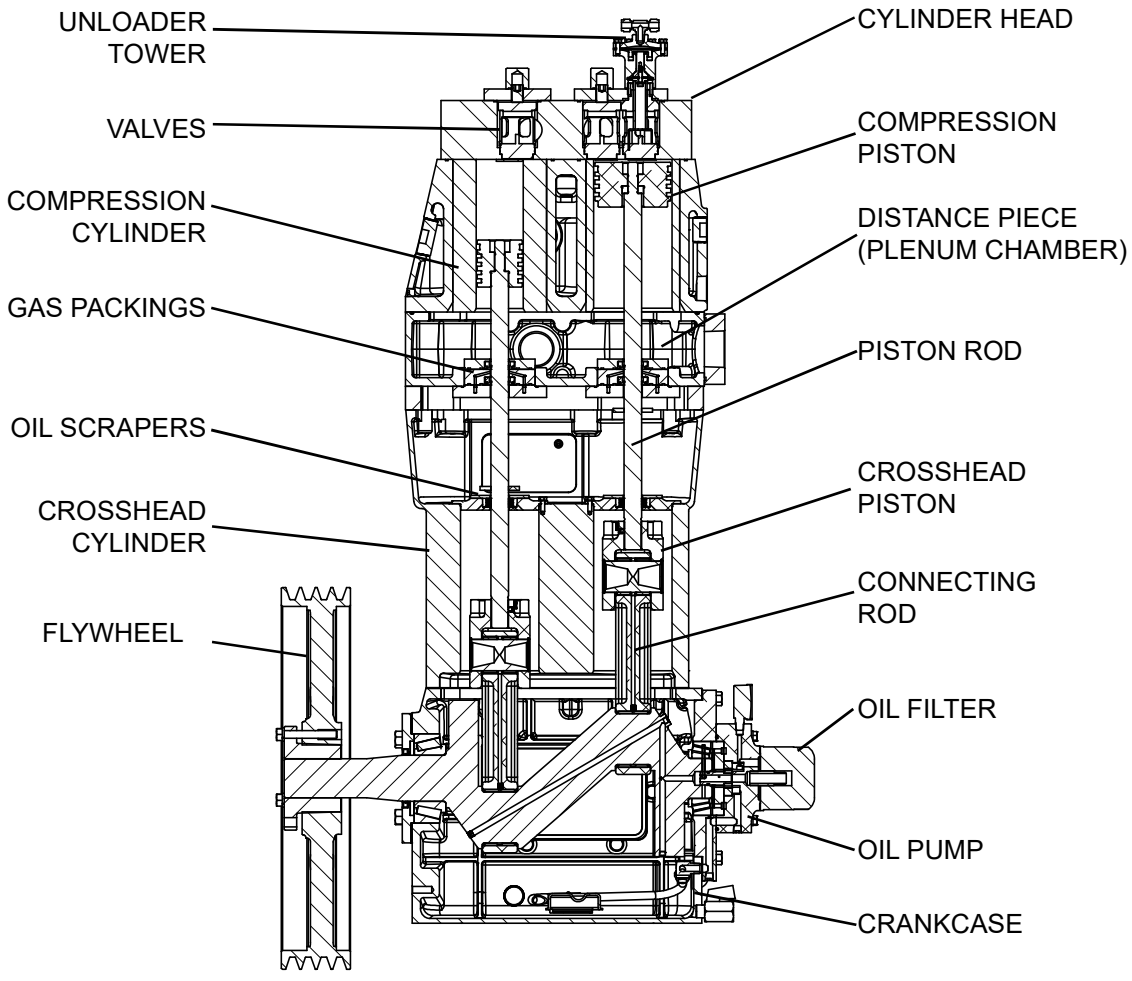


Figure 1: Cutaway of an Odyssey Booster

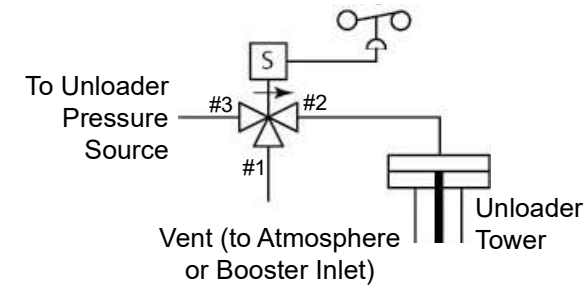
BOOSTER CONTROL PANEL

Your Hycomp booster is provided with a factory installed booster control panel. Optional accessories specific to the control application requirements may also be included. Instructions specific to each unique configuration of control system is provided with the booster.

UNLOADER CONTROLS

Hycomp Odyssey boosters are supplied with an unloading device. This unloading device allows the booster to load and unload based upon discharge and suction pressures, as well as allowing the booster to start and stop unloaded. The unloading device will vary per model.

SUCTION VALVE UNLOADING - Suction valve unloaders utilize unloading towers attached to the booster cylinder head, and a three-way valve to supply process gas pressure to the unloader towers to actuate them. The tower forces the suction valve open, allowing the booster to unload. The three-way valve supplies gas pressure to the unloader towers or dumps that pressure out of the unloader towers (Figure 2 and 3).



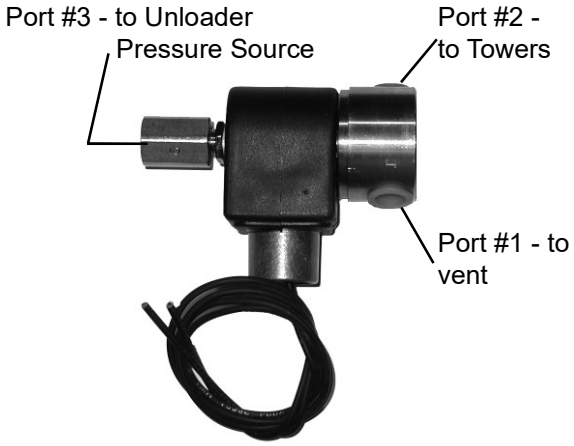


Figure 2: Three-Way Unloader Solenoid Valve Plumbing

Figure 3: Suction Valve (Three-Way) Unloading Solenoid Valve

Unloader Tower - If the unit unloads via Suction Valve Unloading, this item is included. Located on the inlet valve covers, the tower provides the mechanical motion (pneumatically driven via a diaphragm) to physically open the inlet valve(s). The number of towers is dependent on the model of booster. These towers must be supplied with gas pressure to operate the suction valve unloaders. The unloader gas pressure must exceed the inlet pressure by a minimum of 30 psig for the unloader mechanism to operate effectively.

Three-Way Unloader Control Solenoid Valve - Provided on boosters with suction valve unloading (see Figure 2). The three-way unloader control solenoid receives an electrical signal from the microprocessor to engage or release (load or unload the booster). If electrical power is lost or the solenoid fails, the valve will unload the booster. There are three gas ports on the unloader valve, as well as an electrical connection. Port #1 is the vent port. Port #2 is connected to the Unloader Towers. Port #3 is connected to the unloader pressure source (Figure 3).

INLET SHUTOFF VALVE UNLOADING - This unloading method utilizes an actuated valve to close off inlet flow to the booster, thereby preventing the booster from loading. The actuated valve is either a direct acting electrical solenoid valve (Figure 4), or an actuated ball valve that uses a three-way solenoid valve to pneumatically operate a ball valve (Figure 5).

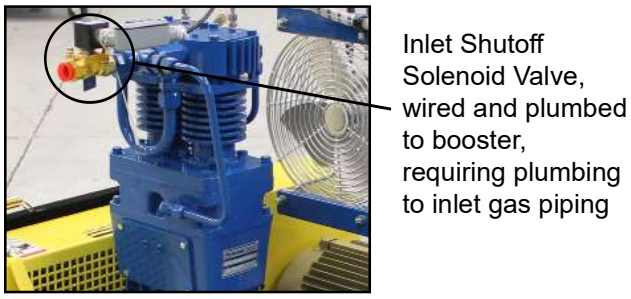
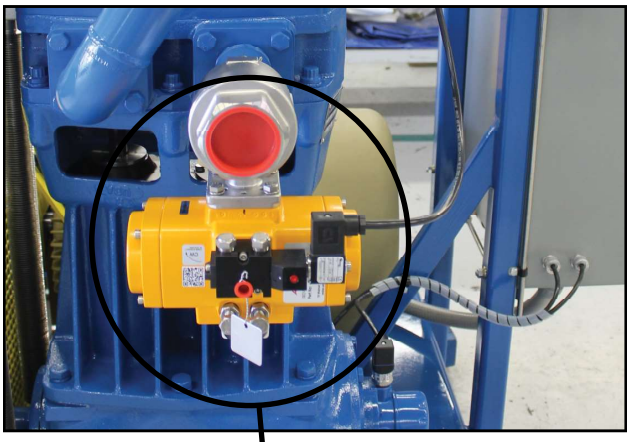


Figure 4: Inlet Shutoff Solenoid Valve Unloading



Actuated Inlet Ball Valve. This valve is wired and plumbed to the booster inlet, but still requires plumbing to gas inlet piping, and a pneumatic pressure source.

Figure 5: Actuated Inlet Ball Valve Unloading

SAFETY DEVICES

The following safety devices are included with your Hycomp booster system (see Figure 6). Lack of these safety devices will void the booster warranty. In addition, damage to equipment and personnel may occur if these devices are not properly maintained and installed. Additional safety devices not listed here may be necessary to properly protect equipment and personnel.

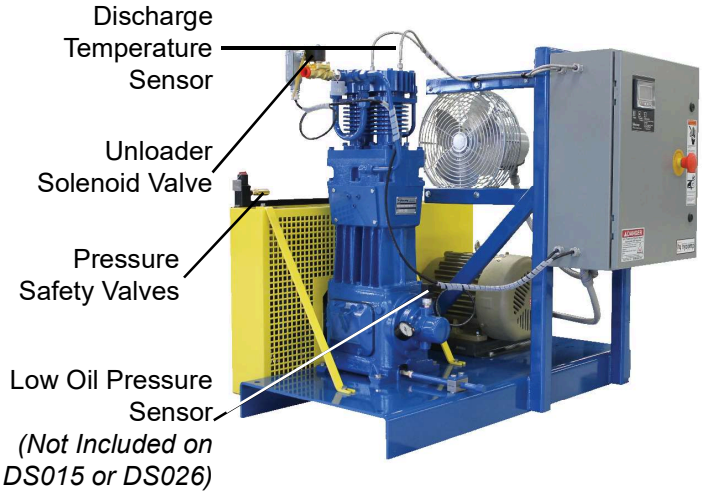


Figure 6: Odyssey Booster with Multiple Safety Devices

Discharge Temperature RTD - An RTD sensor is placed as near to the booster discharge as possible. The temperature from the RTD sensor is displayed on the Human Machine Interface (HMI). The control system has a discharge temperature fault setpoint that will shut down the booster just above its maximum normal operating temperature. Elevated temperatures may be a result from wear and the first signs of valve and ring failure. The temperature can be used as a detection method to help prevent unexpected booster failures. Discharge temperature fault setting must NEVER exceed 340°F. Refer to Discharge Faults in Section 3, Booster Controls.

Low Oil Pressure Transmitter - While oil pressure loss in the crankcase is a rare event, it can result in extensive and costly damage to the booster. A low oil pressure sensor set to shut down the booster at 14 PSIG for DS033, DS044, DS060, DS081, and DS087 (35 PSIG for DS133, DS192, and DS303) is installed at the oil pump to shut down the booster in case of lubrication failure. The oil pressure is displayed on the HMI. A 5-10 second delay timer is used to lock out the fault at start-up. Refer to Run Timing and Low Oil Pressure Fault in Section 3, Booster Controls. *The Low Oil Pressure Transducer is not included on the DS015 and DS026.*

Suction Pressure Transmitter - A suction pressure transmitter is installed in the control panel. A pressure sensing line must be plumbed between it and the suction pressure storage vessel. The suction pressure is displayed on the HMI. A High Suction Pressure Fault will shut down the machine when suction pressure exceeds the maximum pressure rating of the booster. Refer to Suction Faults in Section 3, Booster Controls.

Discharge Pressure Transmitter - A discharge pressure transmitter is installed in the control panel. A pressure sensing line must be plumbed between it and the discharge pressure storage vessel. The discharge pressure is displayed on the HMI. A High Discharge Pressure Fault will shut down the machine when discharge pressure exceeds the maximum pressure rating of the booster. Refer to Discharge Faults in Section 3, Booster Controls.

Pressure Safety Valve - Pressure safety relief valves prevent dangerous over-pressurization by relieving system pressure when compressed gas reaches the maximum operating pressure of the system. Failure to provide properly sized pressure relief valves can cause property damage, personal injury, or death. Pressure safety valves are preset by the manufacturer and the settings should not be changed by anyone other than the manufacturer or an authorized service facility. Any line leading to or from a booster that can be blocked by a valve or other device, whether during normal operation or during a failed operation, MUST be equipped with a safety relief device. The safety valve must be of a material compatible with the gas being compressed and must be able to handle a flow in excess of the maximum flow of the booster.

INSPECTION AFTER EXTENDED STORAGE

If the booster has been out of service for an extended length of time, verify that the cylinder bores and valve pockets are free of rust and other debris. Inspect the crosshead bores for signs of rust.

Drain the oil from the crankcase and remove the inspection cover plate. Inspect inside the crankcase for signs of rust or contamination. Clean and/or replace parts if they exhibit signs of corrosion. Refill the crankcase with the proper weight and amount of oil. Squirt oil onto all bearing areas, ensuring all bearings have fresh oil.

Squirt oil onto the piston rod oil scrapers by removing the oil scraper cover. Apply enough oil to ensure that the crosshead cylinder bores receive oil. Remove the oil scraper case if necessary to ensure oil is applied to the crosshead bores.

Rotate the unit manually to ensure everything rotates smoothly and no interference or friction can be felt.

BOOSTER SPEED

The lubrication systems of Hycomp model boosters are designed to operate at speeds of 394 RPM and above. Do not operate below 394 RPM without consulting factory.

Hycomp boosters should not be run at speeds above 722 RPM without consulting factory. While these boosters have been operated at speeds in excess of 722 RPM, reduced volumetric efficiencies along with shortened valve and piston ring life result. Hycomp recommends keeping booster speed below the maximum recommended speed for optimum service life and warranty compliance.

CRANKCASE LUBRICATION

Hycomp boosters ship with HYSYN SAE 30/ISO 68 synthetic booster oil in the crankcase, unless otherwise requested. All Hycomp booster models have fully pressurized crankcase lubrication system fed by a gerotor type constant pressure oil pump, with the exception of the DS015 and DS026 boosters, which are splash lubricated. With the HySyn, oil change requirements are every 8,000 hours of run time or 12 months, whichever occurs first. In any case, oil should be changed whenever the oil becomes visibly contaminated. Check oil level weekly on continuous run units. Oil level should be maintained between the two marks on the oil dip stick, located on the side of the running gear, or a small air bubble on top of the oil level gauge located on the oil pump side of the DS133, DS192, or DS303. Do not flush the crankcase with solvents, as this will dilute the oil. All pressure oil lubricated boosters come standard with a spin-on oil filter. This filter must be replaced at the same time the oil is changed.

Oils come in several viscosities suitable for different operating conditions. See Table 1 for SAE oil viscosity recommendations and Table 2 for crankcase capacities.

Ambient Temperature	Oil Viscosity
0 to 32°F (-18 to 0°C) 32 to 80°F (0 to 27°C) Above 80°F (>27°C)	SAE 10W / ISO 32 SAE 20W / ISO 46 SAE 30W / ISO 68

Table 1: Oil Viscosity

Block	Quarts
DS015, DS026	7/8
DS033, DS044	2
DS060, DS087	6
DS081	9
DS133, DS192, DS303	9

Table 2: Oil Capacity by Model

At ambient temperatures below 0°F (-18°C), a crankcase heater must be installed. Hycomp recommends a 70°F (21°C) thermostat setpoint, with SAE30/ISO68 oil.

NOTE: DO NOT MIX SYNTHETIC OIL WITH TRADITIONAL BOOSTER OIL.

OIL PRESSURE REGULATION

Oil pressure regulation is accomplished by an adjustable, spring loaded valve, located in the bearing carrier on the end of the booster opposite the flywheel. Pressure is controlled by an adjusting screw and lock nut. Adjustment must be made while the booster is running. Increase in pressure is accomplished by a clockwise rotation of the adjusting screw (see Figure 7).

DS033, DS044, DS060, DS081, DS087 - Set the oil pressure to 18-22 PSIG with the booster at normal operating temperature.

DS133, DS192, DS303 - Set the oil pressure to 45-50 PSIG with booster at normal operating temperature.

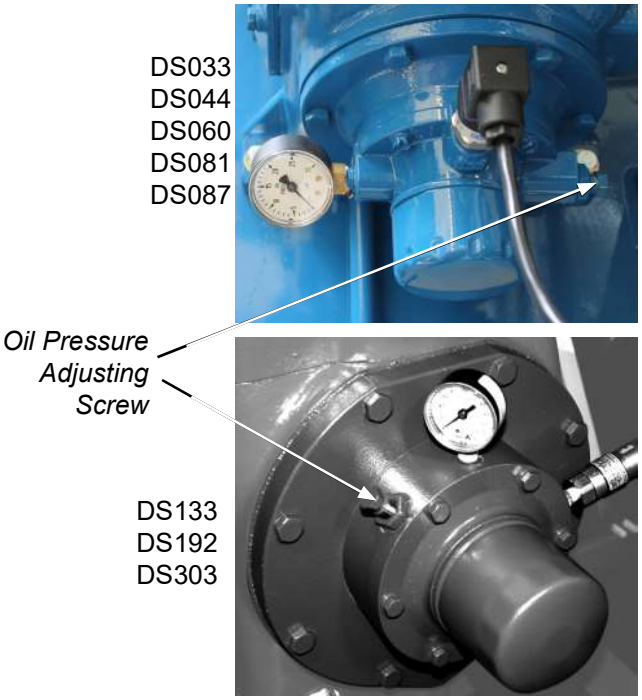


Figure 7: Oil Pumps

CONTROL PANELS

The control panel contains the electrical components used to control the package or system. Hycomp supplies only high quality components, they are reliable and robust. However, because of the delicate nature of any electronic component, great care must be taken to keep the control panel and its internal components free of debris, dust, and moisture (see Figure 8).

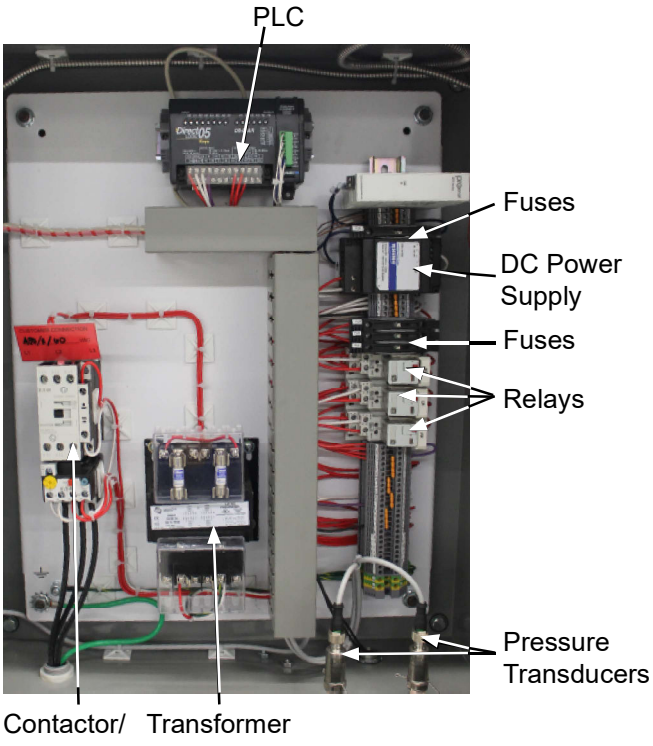


Figure 8: Control Panel and Parts

Human Machine Interface (HMI) - Your control panel may be supplied with an HMI; this is the display on the outside of the panel used to monitor and control the functions of your Hycomp system (see Figure 9).

Some of the user functions displayed on the HMI may include the following information, depending on application:

Real time unit run conditions.

Real time pressures and temperatures.
- Discharge Temperature
- Discharge Pressure
- Suction Pressure
- Oil Pressure

Unit load and unload status.
- Unit enabled/disabled
- Unit standby and run conditions
- Active faults
- Pressure and temperature set point adjustments
- Fault and alarm set points
- Timing set points

Figure 9: HMI Screen

Programmable Logic Controller (PLC) - Your Hycomp system is supplied with a Hycomp factory control panel that contains a PLC. This acts as the "brain" of the system; it contains proprietary software and programming specific to your Hycomp unit. The HMI is the interface to the PLC to input user options, acknowledge and clear alarms or faults, and monitor the run conditions of your Hycomp system.

Note: The PLC and HMI are not field serviceable. Please contact Hycomp factory support with any questions or issues.

Resistance Temperature Detector (RTD) - Your Hycomp system has calibrated RTD(s). This device is used to monitor temperature at various points on

the Hycomp unit.

Note: Your Hycomp booster or booster must not exceed 340 F under any circumstance, exceeding this will cause rapid failure of your Hycomp unit!

The RTD uses resistance to read temperature and transmits that resistance to the PLC where it will be converted to F (Fahrenheit) or C (Celsius).

Note: Do not modify the wires on the RTD. Doing so will change the calibrated resistance of the RTD and it will no longer accurately read temperature.

Pressure Transmitter - Your Hycomp system has pressure range specific transmitters. These are used to monitor system pressures at certain points. Examples of these points include: suction pressure, discharge pressure, and oil pressure. The transducer sends a signal in milliamps to the PLC where it is converted into PSIG, PSIA, Bar, or kPa depending on your specific requirements.

Note: Only use Hycomp supplied transmitters. Transmitters with the incorrect range can damage your Hycomp unit. Never offset or scale a transmitter without first contacting Hycomp factory service for advice.

Motor Contactor and Overload Protection – Your Hycomp system has a motor contactor and overload protection (motor starter). This device is what starts and powers the drive motor on your Hycomp system. It is controlled by the PLC and a run relay. When the coil on the contactor receives current the coil pulls the high voltage contact closed and completes the high voltage circuit to the drive motor. In the event of a motor high amp draw condition, the overload will interrupt the low voltage to the coil, causing the high voltage contacts to open, breaking the high voltage circuit to the motor. This protects both the motor and Hycomp booster. Contactors and overloads are also provided for optional fan motors.

Note: The motor contactor is a high voltage component. Great care, proper isolation and Lockout/Tagout procedures of incoming electrical power must be followed before any service or troubleshooting. Failure to follow proper procedures can result in serious injury or death.

Transformer – Your Hycomp system has a transformer. This device “steps down” high voltage to low voltage used to power low voltage components in the panel.

Relays – Your Hycomp system has relays; these take a signal from the PLC and relay power to a specific system control component. Some examples of these relays might include the following:

“RR,” or run relay, sends current to the motor contact coil.

“LR,” or load relay, controls the load/unload mechanism.

Other relays may be used in specific applications. Please refer to your factory supplied electrical drawings or contact Hycomp factory support for advice.

DC Power Supply – Your Hycomp system has a DC power supply; this is used to convert AC current to DC current for the transmitters and other DC powered components.

Fuses – Your Hycomp system has fuses; these are used to protect components downstream of the fuses in the event of a short or high amp draw.

Note: Panel fuses should not be used as positive electrical isolation when servicing components on the circuit. Please follow proper isolation and Lockout/Tagout procedures. Failure to do so could result in serious injury or death.

Caution: The control panel summary only applies to Hycomp factory supplied controls. Any user supplied control is not the responsibility of Hycomp, and any damage to the Hycomp booster or booster is not the responsibility of Hycomp.

SECTION 3 BOOSTER CONTROLS

INTRODUCTION AND OPERATING SCHEME

The Odyssey Controller is specifically designed to work with Hycomp oil-free boosters, providing increased longevity and enhanced control.

This offers advanced control over the timing and unloading, allowing the user to fine-tune the controls to the specific needs of their application. This leads to fewer unnecessary starts/stops, component longevity, fewer faults, and increased energy efficiency.

The system continuously monitors the following system parameters:

- Suction Pressure
- Discharge Pressure
- Discharge Temperature
- Oil Pressure *Not available on DS015 or DS026*

This information is used to shut down the booster in case of a fault to protect the booster from possible damage. Fault and alarm indication is shown via the HMI screen. Faults can also be wired to a remote alarm, such as a light, a horn, or even a display on a plant control screen.

Suction and discharge pressures are monitored and used to load and unload the booster based upon field adjustable pressures. The panel will also unload the booster at startup and shutdown so the booster does not start loaded against a pressure.

INSTALLATION

The Control Panel comes mounted to the booster skid, pre-wired and plumbed. The control panel has been fully factory tested with the corresponding booster to ensure complete system cohesion.

Note: All panels come with grounding lugs which must be properly grounded, per local code.

Warning: While servicing the panel, follow standard lockout/tagout procedures to prevent injury.

Warning: Arc flash hazard. Wear appropriate PPE to prevent injury.

Consult the current National Electric Code (NEC) and local codes for proper wire and conduit sizing for connection to the electric motor. Proper grounding of the panel is also required. Every control panel comes with properly sized grounding lugs. Consult the electrical schematic provided with the booster for proper wiring of the instrumentation and control devices.

Voltage may be supplied to the control panel through a transformer included inside the panel. This transformer can be wired for 460 VAC or 230 VAC based on the power requirements of the booster motor. Other voltages, such as 380 VAC and 575 VAC, are also available. Any control panel that is shipped loose from the booster package will be set for 120 VAC, unless otherwise specified inside the control panel. Refer to electrical schematic drawings furnished with the project for correct wiring and jumper locations.

Warning: While servicing the panel, follow standard lockout/tagout procedures to prevent injury.

REMOTE USER DEFINED FAULT

The User Defined Fault allows the user to shutdown the booster based on user defined conditions. This could be a fault upstream or downstream of the booster requiring it to shutdown, such as a plant wide shutdown command, a remote stop, or any other condition the user identifies as necessary for the booster to shutdown. This is accomplished by removing jumper (J6) and wiring a normally closed circuit between terminal blocks 5 and X1 (on the PLC). When the fault occurs the circuit must open; the booster will shutdown and a fault indication will appear on the screen displaying “USER DEFINED FAULT.”

OPERATION

The system is controlled via a Programmable Logic Controller (PLC). User interaction is handled via a touchscreen or HMI. The HMI allows the user to view current operating conditions, booster status indicators, and adjust both setpoints and timers.

USER INDICATION AND PANEL LAYOUT

The main components on the front of the panel are as follows:

E-Stop - This will remove power from the PLC, associated I/O, HMI, and 24 volt supply. Some high voltage and 120 VAC power will still be present. Complete full lockout/tagout for complete electrical isolation.

Warning: When the e-stop is depressed, high voltage and/or 120 volt power are still present. Serious injury or death may occur. Only qualified personnel should access the electrical panel.

HMI - This touchscreen interface is designed to allow the operator to view status as well as change setpoints. A full description of the interface follows.

PRESSURES

Unless otherwise noted, all pressures are gauge pressures. The units will be displayed as PSI, Bar, or kPa.

HMI

The HMI or touchscreen and function keys provide precision and ease of use by allowing the user to navigate to different screens and menus. All information is viewed or entered in a menu or data screen. The controls are designed, engineered, and manufactured to provide complete access to all the information, adjustments, and setpoints available to the user.

Warning: Setpoints are set from the factory for each booster. Changes will affect the performance and integrity of the booster. Please consult the factory before making changes to setpoints.

FUNCTION KEYS

Each screen is described in this manual. The Functions Keys provide a quick user interface. These function keys or buttons are described below.

Start Function Key

Stop Function Key

Back Function Key:
Navigate back to previous screen

Process Overview Function Key:
Navigate to process overview (Figure 10)

Main Menu Function Key:
Navigate to the Main Menu (Figure 15)

PROCESS OVERVIEW

The HMI boots up with the Process Overview (see Figure 10). The following information is presented on this screen.

Pressures: Suction and Discharge Pressures are displayed in psi. Each system is configured to match the requirements of the booster. Monitoring these pressures will help identify potential problems.

System Status:
Started - System is started and the booster will automatically start and stop based on suction and discharge load conditions.

Stopped - System is stopped.

Figure 10: Process Overview

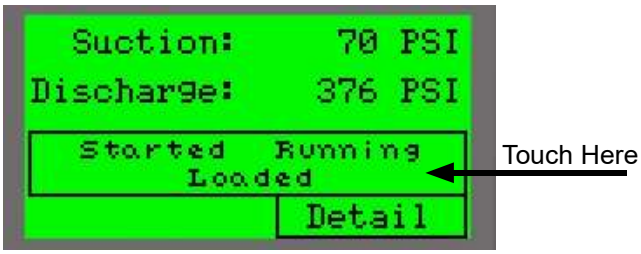


Figure 11: Booster Status Button

Figure 12: Booster Detail with Oil Option

Booster Status:
Faulted - A fault is present and the booster is not ready to run. Resolve all faults and reset them from the Current Fault/Alarm screen (see Figure 36).

Off - The booster is disabled and will not start automatically.

Ready - The booster has no faults and will automatically start when load conditions are met.

Running - The booster is running.

Load Status: This displays the state of the booster loading. The booster can be running but not loaded.

Unload Suction - Booster is unloaded because the suction pressure has fallen below the minimum pressure allowed for loading. Refer to the Suction Loading Setpoints Screen section (see Figure 19).

Unload Discharge - Booster is unloaded because the booster discharge pressure has reached the unload pressure setpoint. Refer to the Discharge Loading Setpoints Screen section (see Figure 17).

Unld Suct & Disch - Booster is unloaded because the booster discharge pressure has reached the unload pressure setpoint and the suction pressure has fallen below the minimum pressure allowed for loading. Refer to the Suction/Discharge Loading Setpoints screens (see Figure 17 and Figure 19).

Loaded - Booster is loaded.

Force Unload - Force Unload is ON, the booster will run unloaded until turned OFF, regardless of other settings. Go to the Booster Options screen to turn Force Unload (see Figure 13) on or off.

BOOSTER DETAIL

The Booster Detail (see Figure 12) displays the Run Hours and Load Hours, as well as the oil pressure and the discharge temperature. Navigate to the detail screen by pressing the booster status button on the Process Overview screen or Detail button (see Figure 11). The Run Hours displays total booster run time to 1/10 of an hour. The Load Hours displays the total number of hours the booster has been loaded to 1/10 of an hour. Monitor these to ensure that maintenance is done at the correct intervals and to diagnose production issues.

Note: Your particular screen will not include the oil pressure if you have a DS015 or DS026.

BOOSTER OPTIONS

The Booster Options screen (see Figure 13) allows the user to perform one of three actions. These actions should be used on the initial startup and they may be used for troubleshooting the booster. Navigate to the booster options screen by pressing the options button on the booster detail screen (see Figure 12).

Jog - When pressed, this button will energize the main motor contactor, causing the booster system to run while the button is being pressed. This is a momentary button and will release when no longer being pressed. **This button is only available when the system is stopped (see Figure 14).**

Force Unload - When pressed, this button forces the booster to unload. **Note: This button stays ON**

Figure 14: Booster Options - System Running

Figure 16: Setpoint Menu

once pressed and must be pressed again to turn OFF. When the force unload is ON, the booster will run unloaded until turned OFF, regardless of other settings.

Manual Load - When pressed, this button will energize the load relay, energizing the load solenoid valve, causing the booster system to load while the button is being pressed. This is a momentary button and will release when no longer being pressed. **This button is only available when the system is stopped and the booster motor is off (see Figure 14).**

MAIN MENU

The Main Menu screen can be reached via the Main Menu function key.

The four navigation buttons on this screen (see Figure 15) will navigate to the following areas:

Setpoints (see Figure 16): Use the Setpoint Menu to change setpoint parameters.

User Options (see Figure 23): Use the User Options to change display units and save/restore setpoints.

Setup (see Figure 28): Use the Setup Menu to change setup parameters.

Current Fault/Alarm (see Figure 36): View Current Fault or Alarm and reset faults or alarms.

Figure 15: Main Menu

SETPOINT MENU

The three navigation buttons on this screen will navigate to the following areas:

Discharge (see Figure 17): Navigate here to change the discharge load/unload settings.

Suction (see Figure 19): Navigate here to change the suction load/unload settings.

Timing (see Figure 20): Navigate here to change the following: Unload Timeout, Oil Pressure Fault Delay, and Shutdown Delay.

DISCHARGE SETPOINTS

Press the box that contains the load setting you wish to change. Use keypad (see Figure 18) to enter desired values. Clear current data before entering new data. These values must be entered between the factory set minimum and maximum values. Press ENT to load a new value. Press ESC to retain the previous value.

- ESC: Escape
- BS: Back Space
- CL: Clear
- ENT: Enter

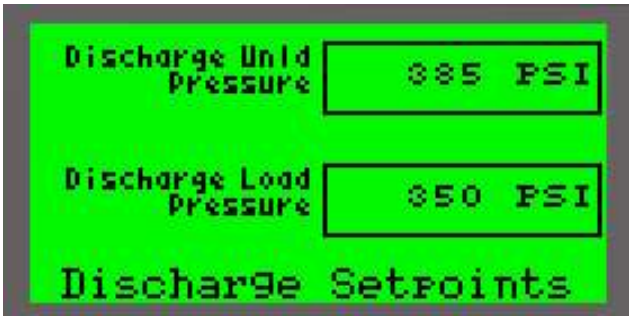


Figure 17: Discharge Setpoints

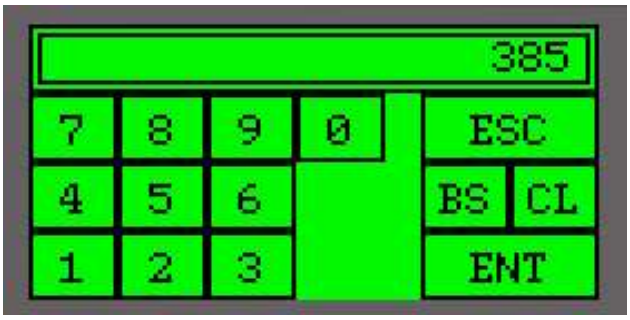


Figure 18: Keypad

Figure 20: Timing Menu

KEYPAD

Note: If the value entered is outside factory set limits, the value will be forced by the PLC to the upper or lower factory limit.

Load and unload setpoints are described below.

Discharge Unload Pressure - This is the rising pressure at which the booster will unload due to sufficient discharge pressure. This pressure must be set higher than the Discharge Load Pressure. If it is set lower, it will automatically reset itself 2 psi higher than the Discharge Load Pressure setpoint. Typically, increase this setpoint 15 psi above the Discharge Load Pressure to ensure that the booster does not load and then unload in less than 10 minutes.

Discharge Load Pressure - This is the falling pressure at which the booster will re-load due to insufficient discharge pressure. This pressure must be set lower than the Discharge Unload Pressure. This setpoint must also be set above your desired tank pressure. Typically 5-10 psi accounts for pressure drop and ensures proper loading.

SUCTION SETPOINTS

Press the box that contains the load setting you wish to change. Use keypad (see Figure 18) to enter desired values.

Suction Unload Pressure - This is the falling pressure at which the booster will unload due to insufficient suction pressure. This pressure must be set at least 2 psi below the Suction Load Pressure.

Suction Load Pressure - This is the rising pressure at which the booster will re-load due to sufficient suction pressure. This pressure must be set higher than the Suction Unload Pressure. If it is set lower, it will automatically force the unload pressure to 2 psi lower than the Suction Load Pressure setpoint.

TIMING MENU

Run Timing - Navigate here to change the Unload Timeout and Low Oil Pressure (LOP) Fault Delay.

Shutdown Timing - Navigate here to change the shutdown delay.

RUN TIMING

Press the box that contains the timing setting you wish to change (see Figure 21). Use keypad (see Figure 18) to enter desired values.

Unload Timeout - The amount of time (in minutes) that the booster will run unloaded before shutting down. This time setting should be adjusted to match the daily flow requirements, without the booster starting/stopping more than six times per hour, less if the motor design does not allow six. If the flow requirement causes the booster to start/stop more than the recommended amount, then increase the unload timeout value. This can be set between 0.1 and 60.0 minutes (see Figure 21).

Figure 19: Suction Setpoints

Figure 21: Run Timing

Low Oil Pressure (LOP) Fault Delay - The amount of time (in seconds) that the booster will not fault due to low oil pressure during startup. This helps to prevent faults and allows the booster to build oil pressure when first started. This can be set between 1.0 and 15.0 seconds. Variations in ambient conditions may require adjusting this value to reduce fault trips (see Figure 21). *Not available on DS015 or DS026.*

SHUTDOWN TIMING

Press the box that contains the timing setting you wish to change (see Figure 22). Use keypad to enter desired values.

Figure 22: Shutdown Timing

Shutdown Delay - The amount of time (in seconds) the booster will remain running after the local or remote stop is pressed. This allows the booster to unload prior to stopping. This can be set between 2.0 and 3.0 seconds.

USER OPTIONS MENU

Units - Navigate here to change pressure units to display in psi, Bar, or kPa or to change temperature units to display in °F or °C (see Figure 23).

Figure 23: User Options with Local and Remote Start/Stop Enabled

Defaults - Navigate here to restore factory defaults.

Diagnostics - Navigate here to diagnose capacity and load issues or for PLC mode status.

Units

The units screen (see Figure 24) allows the user to select which units will be displayed. Press the pressure unit button to toggle between psi, Bar, and kPa. Press the temperature unit button to toggle between °F and °C.

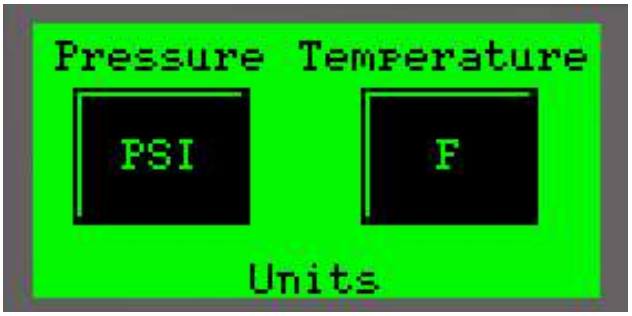


Figure 24: Units

Defaults

The defaults screen (see Figure 25) allows the user to restore the default parameters set from the factory. Press this button to restore the default load/unload setpoints, timing setpoints, fault setpoints, transmitter adjustments, speed control setpoints, manual speed setpoints, speed control PID parameters, and factory configurations from the PLC EEPROM.

Figure 25: Defaults

Press and hold the Restore Defaults button until the text “Defaults Restored” is displayed as shown in Figure 26. This ensures that the restore operation was completed.

Figure 26: Defaults Restored

Diagnostics

The Diagnostics screen (see Figure 27) helps to diagnose booster performance. These seven items can be monitored for diagnosing booster issues.

Figure 27: Diagnostics

1. Run Hours: This is the total amount of time that the booster has been running. Use this value for preventive maintenance scheduling.

2. Load Hours: This is the total amount of time that the booster has been loaded. Use this value to diagnose production issues.

3. Starts Total: This is the total number of times that the booster has been started. This value can be used to determine excessive starting/stopping of the booster motor.

4. Loads Total: This is the total number of times that the booster has been loaded. Use this value to diagnose excessive loading/unloading of the booster.

5. Starts/Hour: This is the total number of times that the booster has been started over the last hour of running time. The booster motor should not start/stop more than six times per hour, less if the motor is not rated for six. Use this value to determine the proper unload timeout setpoint**.**

6. Loads/Hour: This is the total number of times that the booster has been loaded over the last hour of run time. Use this value to help diagnose production capacity issues.

7. PLC Mode: This displays the state of the PLC mode. If in Run mode, the PLC is processing logic. If in stop mode, the PLC is not processing logic and the machine cannot be operated via the PLC.

SETUP MENU

The setup menu (Figure 28) is a menu for all setup data. The software revision number is displayed in the upper right hand corner.

Figure 28: Setup Menu

Faults (see Figure 29) - Navigate here to test fault indication and change the following: High Discharge Pressure, High Discharge Temperature, High Suction Pressure, Low Suction Pressure, and Low Oil Pressure.

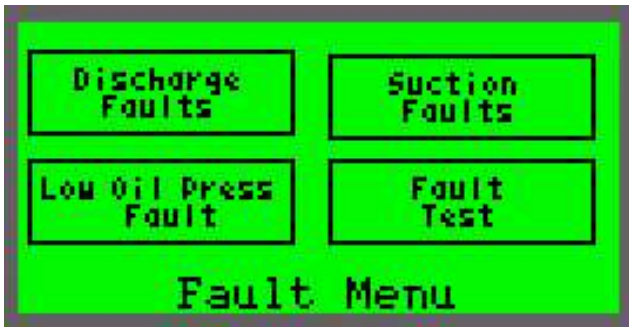


Figure 29: Fault Menu

Factory Setup - This is password protected for factory use only.

Transmitter Adjustments (see Figure 34) - Navigate here to make adjustments to the transmitters if they are not displaying correctly.

FAULT MENU

Discharge Faults (see Figure 30) - Navigate here to change the High Discharge Pressure and High Discharge Temperature fault settings.

Suction Faults (see Figure 31) - Navigate here to change the High Suction Pressure and Low Suction Pressure fault settings.

Low Oil Press Fault (see Figure 32) - Navigate here to change the Low Oil Pressure fault setting.

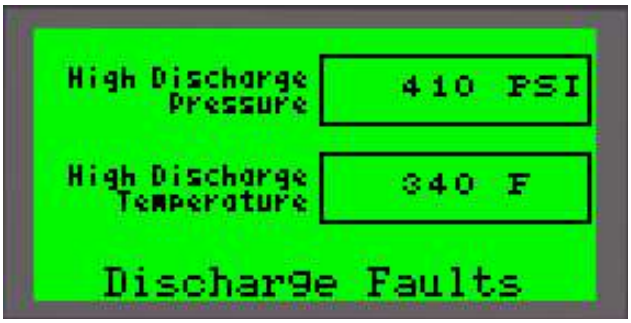


Figure 30: Discharge Faults

Fault Test (Figure 33) - Navigate here to test the fault relay.

DISCHARGE FAULTS

Press the box that contains the fault setting you wish to change. Use keypad to enter desired values. Fault settings are described below.

High Discharge Pressure - If the discharge pressure rises above this setting (see Figure 30) the booster will shut down. Set this pressure above the Discharge Unload Setpoint, but below the rating of the lowest rated component, which should be the discharge safety valve.

High Discharge Temp - If the discharge temperature rises above this setting (see Figure 30) the booster will shut down. The upper limit of the High Discharge Temperature fault setting is factory set and may be set as high as 340ºF. Ideally, this should be set 20-30ºF above normal operating temperature, so that abnormal temperatures (usually indicating a booster problem) may be discovered before a major problem occurs.

SUCTION FAULTS

Press the box that contains the fault setting you wish to change. Use keypad to enter desired values. Fault settings are described below.

High Suction Pressure - If the suction pressure rises above this setpoint (see Figure 31) the booster will shut down. Set this pressure above the Suction Load setpoint but below the rating of the lowest rated component. The High Suction Pressure maximum is factory set to ensure crankshaft protection. The PLC will force the factory setpoint if set above.

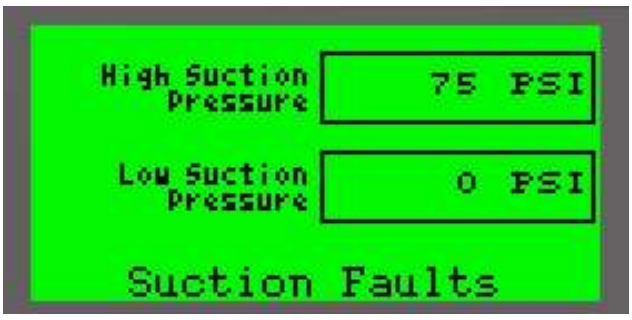


Figure 31: Suction Faults

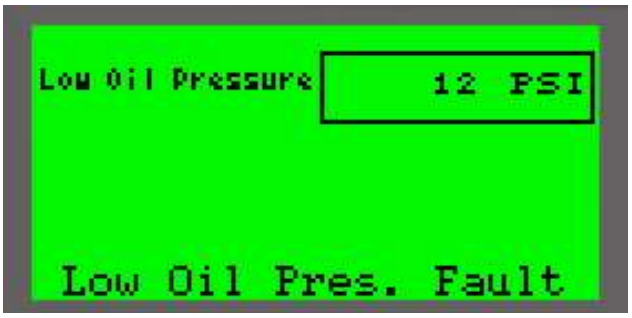


Figure 32: Low Oil Pressure Fault

Low Suction Pressure - If the suction pressure falls below this setpoint the booster will shut down (see Figure 31). If this is set to zero, it will be ignored. Set this pressure to meet your requirements. It must be lower than the Suction Unload setpoint (see Figure 19).

LOW OIL PRESSURE FAULT

Press the box to change the fault setting. Use keypad to enter desired values. *Not available on the DS015 or DS026.* Low Oil Pressure is described below.

Low Oil Pressure - If the oil pressure falls below this setting (see Figure 32) the booster will shut down. Low oil pressure will increase wear on the booster due to insufficient lubrication. Set this pressure high enough to decrease wear but not have nuisance trips. Variations in ambient conditions may require changing the Oil Pressure Fault Delay (see Figure 21). *Not available on the DS015 or DS026.*

FAULT TEST

Fault Test - When pressed (see Figure 33), this button will energize the fault relay. Use this to test remote indication.

Note: This is a momentary button and will release when no longer being pressed.

Figure 33: Fault Test

TRANSMITTER ADJUSTMENTS

The Transmitter Adjustments screen (see Figure 34) allows navigation to the Discharge, Suction, and Oil transmitter (if available) adjustment screens. Use these adjustments when the transmitter is no longer reading correctly and requires adjustment.

Figure 34: Transmitter Adjust

DIGITAL TRANSMITTER ADJUSTMENT

The Discharge Transmitter Adjustment (see Figure 35) screen allows entry of values to be used to adjust the transmitter readings. Adjust the values by pressing the box you wish to change. The Suction and Oil Transmitter Adjustments are performed in an identical manner.

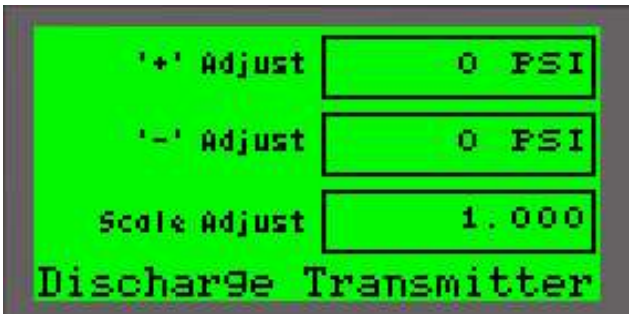


Figure 35: Discharge Transmitter Adjustment

'+' Adjust - This value increases the transmitter value. Use this if the transmitter value is always lower than the actual measured value. For example, if the transmitter always reads 5 psi lower than the pressure gauge reading, add a value of 5 to correct.

'-' Adjust - This value decreases the transmitter value. Use this if the transmitter value is always higher than the actual measured value. For example, if the transmitter always reads 5 psi higher than the pressure gauge reading then subtract a value of 5 to correct.

Scale Adjust - This value multiplies the transmitter value by the input value. This would be used if the displayed value were off by a percentage of the actual. For example, if the actual psi is always 5% higher than the transmitter reading, enter a value of 1.050 to correct.

CURRENT FAULT/ALARM

When a fault or alarm occurs, the following will take place:

1. The screen will change to the Current Fault/ Alarm screen (see Figure 36).

2. The screen color will change to red and will remain red until the fault or alarm condition has been resolved and the Fault Reset button or Alarm Reset button has been pressed on the touchscreen.

3. This screen can also be accessed from the Main Menu (see Figure 15).

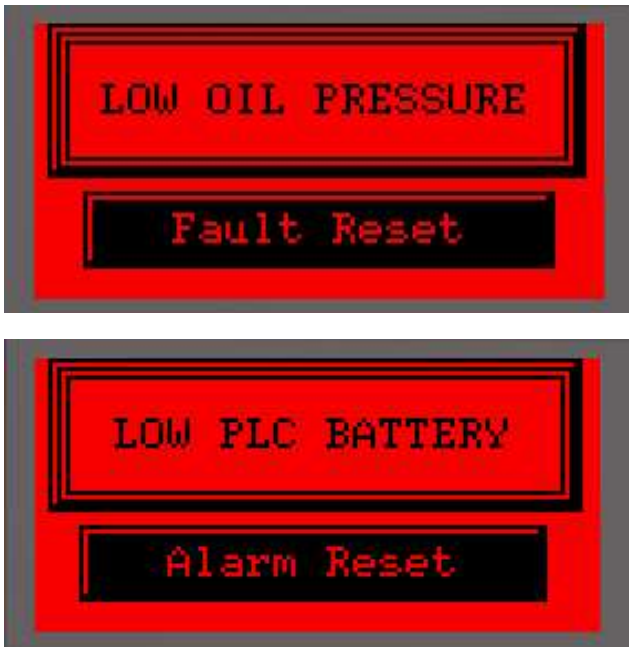
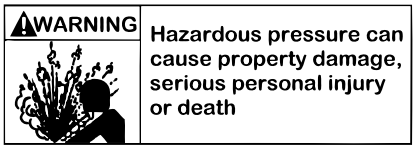
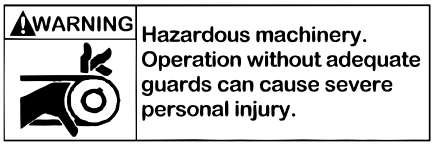


Figure 36: Current Fault/Alarm with fault and alarm shown

SECTION 4 MAINTENANCE AND TROUBLESHOOTING





NOTICE: Hycomp booster service and maintenance shall only be performed by qualified technicians. Service and maintenance shall conform to all applicable local and national regulations and safety standards.

WARNING: Never assume a booster is safe to work on just because it is not operating. It could restart at any time. The following procedures should be used when stopping to maintain or service a booster.

1. Per OSHA regulation 1910.147: *The Control of Hazardous Energy Sources* (lockout/tagout), disconnect and lockout the main power source. Display a sign in clear view at the main power switch stating that the booster is being serviced.

2. Always wear appropriate Personal Protective Equipment (PPE).

3. Isolate the booster from the compressed air/gas supply by closing any manual shut-off valves, upstream and downstream, from the booster. Display signs in clear view at the shut-off valves stating that the booster is being serviced.

4. Lock open a pressure relief valve within the pressurized system to allow the system to completely de-pressurize.

5. Open all drain valves within the area to be serviced.

6. Wait for the unit to cool before servicing. Temperatures above 120°F can cause burns to the skin.

MAINTENANCE SCHEDULE

To insure maximum performance and service life of your booster, a routine preventive maintenance schedule should be developed and followed. As gas boosters have the possibility of causing great damage to personnel and property, a proper maintenance schedule must be created and rigorously adhered to. Table 3 contains a maintenance schedule for boosters housed within a weather proof building, with relatively clean inlet conditions (no acidic components, filtered to 1 micron) and 75°F ambient temperatures, running 8 hours per day. Time frames may need to be shortened in harsher environments.

Contact the factory or your closest authorized Hycomp dealer for questions about designing a PM schedule to fit requirements differing from the listed conditions. Reasonable judgment in the frequency of maintenance and the stocking of spares must be exercised by the customer. **Facilities that cannot afford to be shutdown without excessive costs or hardships must provide a more rigorous schedule and larger quantity of spares than facilities that can do without the booster for a short period of time.**

	DAILY	WEEKLY	2,000 HR	4,000 HR	6 - 8,000 HR	10 - 16,000 HR
VISUALLY CHECK THE BOOSTER	X					
DRAIN THE CONDENSATE FROM PIPING SYSTEM, DRAIN LEGS AND AIR RECEIVER	X					
CHECK SYSTEM PRESSURE (WHILE RUNNING)	X					
CHECK OIL PRESSURE (WHILE RUNNING)	X					
CHECK OIL LEVEL		X				
CHECK FOR OIL IN DISTANCE PIECE		X				
CHECK V-BELT TENSION			X			
INSPECT INTAKE FILTER ELEMENT			X			
CHECK FOR LEAKS IN THE PIPING SYSTEM				X		
MANUALLY OPERATE ALL SAFETY VALVES				X		
VALVE SERVICE (KIT 1)				X		
RING REPLACEMENT (KIT 2)					X	
VALVE REPLACEMENT (KIT 3)					X	
SCRAPER & PACKING REPLACEMENT (KIT 4)						X

NOTE: IF UNIT HAS A CRANKCASE HEATER IN THE OIL DRAIN, OIL REMOVAL WILL REQUIRE A PUMP OR SUCKER.

Table 3: Maintenance Schedule

MOTOR SIZE	16 HOURS A DAY	24 HOURS A DAY
5 HP - 7.5 HP	40,000 hours	32,000 hours
10 HP - 40 HP	24,000 hours	12,000 hours
50 HP - 75 HP	9,000 hours	6,000 hours

Table 4: Motor Bearings Lubrication Schedule

FAULTS AND ALARMS

The control system has various safety shutdowns and protections for potential faults while providing local indication of these faults and a relay for remote indication. It uses local alarms to warn of non-critical problems.

FAULT/ALARM INDICATION

When a fault or alarm occurs, the Fault/Alarm screen (see Figure 36) will be displayed and indicate the current fault or alarm.

Remote fault indication is accomplished via a fault relay within the panel (see Section 3, INSTALLATION). Terminal blocks are provided for user connection to the relay (see booster electrical schematic for details). The circuit is configured normally open. Open indicates no fault and closed indicates a fault.

FAULT/ALARM CLEARING

To clear the fault or alarm once it has been resolved, you must navigate to the Current Fault/Alarm screen (see Figure 36) and press the Fault Reset button, shown when a fault is present, or Alarm Reset button, shown when an alarm is present.

If Remote Start/Stop is enabled, the remote start must be turned off and back on again to restart the booster after a fault.

If power was removed from the panel during correction of the fault or alarm, the fault or alarm will automatically clear upon application of power.

FAULT DESCRIPTIONS

The control panel has protection and shutdowns for the following:

- High Discharge Temperature
- Booster Motor Overload
- Fan Motor Overload
- User Defined Fault
- Low Oil Pressure
- Low Suction Pressure
- High Suction Pressure
- High Discharge Pressure
- Oil Pressure Signal Lost
- Suction Pressure Signal Lost
- Discharge Pressure Signal Lost
- Discharge Temp Signal Lost
- Discharge Valve Failed to Open
- Discharge Valve Failed to Close

High Discharge Temp - The discharge gas temperature of the booster has exceeded the pre-set maximum (see Figure 30). The absolute maximum allowable temperature is 340°F. Factory settings may limit this below 340°F. Correct the problem that caused the high discharge temperature before re-starting.

Comp Motor Overload (O/L) - The booster motor has drawn an electrical current beyond its rated maximum. This protects the motor from damage due to over-current situations. Correct the problem that caused motor overload before re-starting.

Fan Motor O/L - The fan motor(s) have drawn an electrical current beyond their rated maximum. This protects the motor(s) from damage due to over-current situations. Correct the problem that caused motor overload before re-starting. Available only on boosters with an optional cooling fan or fan cooled intercooler/aftercooler.

User Defined Fault - The User Defined Fault allows the user to shutdown the booster based on user defined conditions. This could be a fault upstream or downstream of the booster requiring it to shutdown, such as a plant wide shutdown command, a remote stop, or any other condition the user identifies as necessary for the booster to shutdown. Refer to Section 3, INSTALLATION.

Low Oil Pressure - The oil pressure in the crankcase has fallen below the pre-set minimum pressure (see Figure 32). This fault is delayed for a user set amount of seconds at startup (see Figure 21), to allow the oil pump to build pressure. After startup, a fault will result in immediate shutdown. Correct the loss of oil pressure problem before re-starting. *Not available on DS015 or DS026.*

Low Suction Pressure - The suction pressure has fallen below the minimum allowable pressure (see Figure 31) in the suction tank. Find the cause of the pressure loss and correct it before continuing. If this is set to zero, it will be ignored.

High Suction Pressure - The suction pressure has exceeded the maximum allowable pressure (see Figure 31) in the suction tank. Find the cause of the excess pressure and correct it before continuing.

High Discharge Pressure - The discharge pressure has exceeded the maximum allowable pressure (see Figure 30) in the discharge tank. Find the cause of the excess pressure and correct it before continuing.

Oil Pressure Signal Lost - The PLC has lost connection with the oil pressure transmitter. This is caused by a transmitter failure or faulty wiring

between the PLC and the transmitter. Fix the problem before continuing. *Not available on DS015 or DS026.*

Suction Press Signal Lost - The PLC has lost connection with the suction pressure transmitter. This is caused by a transmitter failure or faulty wiring between the PLC and the transmitter. Fix the problem before continuing.

Discharge Press Signal Lost - The PLC has lost connection with the discharge pressure transmitter. This is caused by a transmitter failure or faulty wiring between the PLC and the transmitter. Fix the problem before continuing.

Discharge Temp Signal Lost - The PLC has lost connection with the discharge temperature sensor. This is caused by sensor failure or faulty wiring between the PLC and the sensor. Fix the problem before continuing.

Discharge Valve Failed To Open - The PLC told the discharge valve to open, but the discharge valve position switch indicates it is still closed. Check the discharge valve to ensure that it is changing positions and the position switch to ensure that it is signaling correctly. Fix the problem before continuing. *Available only on boosters with an optional discharge ball valve.*

Discharge Valve Failed To Close - The PLC told the discharge valve to close, but the discharge valve position switch indicates it is still open. Check the discharge valve to ensure that it is changing positions and the position switch to ensure that it is signaling correctly. Fix the problem before continuing. *Available only on boosters with an optional discharge ball valve.*

TROUBLESHOOTING

WARNING: The booster MUST be locked out from all energy sources prior to inspection, and all pressure MUST be relieved from unit to prevent unexpected release.

There are times when any booster, no matter how well built and how accurately maintained, will exhibit some trouble. While Hycomp engineers are available to assist any customer experiencing booster difficulties, the following tables are provided to assist with initial diagnostics.

Find the section describing the general problem exhibited, then check the probable cause.

If it is not possible to diagnose the cause of the problem, contact Hycomp or a Hycomp authorized dealer for assistance.

The only additional problem encountered with the gas boosters is excess loss of gas through the packings. The problem is generally caused by improper maintenance of the gas packings. However, if the gas packings have been well maintained and leaks still persist, contact the factory.

INSUFFICIENT PRESSURE OR VOLUME

PROBABLE CAUSE	SUGGESTED REMEDY
AIR / NITROGEN LEAKS	Locate air/nitrogen leaks by sound or soap bubble test. Tighten or replace leaking fittings only after reducing air/nitrogen pressure to zero.
LEAKING VALVES	Remove valves and inspect for damage to valve seat or valve disc. Replace suspect components and reinstall valves using new valve seat gaskets and cover gaskets.
PISTON RING NOT SEALING	Remove piston rings and check for wear. If ring thickness has been reduced to 3/16” or less at any spot, the rings should be replaced. Do not bore or hone the cylinder unless it is badly scored or pitted.
BLOWN GASKETS	Check cylinder head and valve gaskets. Replace as necessary.
VALVE UNLOADERS NOT FUNCTIONING PROPERLY	With the booster running, disconnect the tubing to the valve unloader on the cylinder head. If hissing sound is not heard (air/nitrogen escaping), but the booster continues to run partially or completely unloaded, remove the unloader assemblies and valves and inspect. If a leak is detected from the disconnected tubing with the booster, check for sufficient pressure at pressure gague (180 PSIG - 200 PSIG). If sufficient pressure, inspect the unloader solenoid for correct operation.

KNOCKING OR THUMPING SOUNDS

PROBABLE CAUSE	SUGGESTED REMEDY
LOW OIL LEVEL	Check for proper oil level. If low, check for damage to bearings.
NO OIL PRESSURE	Check all possible remedies listed under “low oil pressure” in this section.
LOOSE FLYWHEEL OR MOTOR PULLEY	Check for tightness of flywheel and pulley clamping bolts.
WORN BEARINGS	Inspect connecting rod inserts and wrist pin bushings for excessive wear. Replace as necessary.
LOOSE ROLLER MAIN	Check for crankshaft end play by pushing and pulling on flywheel. If play can be felt, check for damage to roller bearings. If no damage is evident to the bearings, proceed with removing crankshaft end play per service section.
LOOSE GUIDE PISTON	Check diameter of guide piston. If within specification, guide cylinder may be worn.
WORN COMPRESSION PISTON GUIDE RING	Replace guide ring by removing cylinder head and piston. Check compression cylinder and piston for damage.
VALVE ASSEMBLIES LOOSE	Remove valves and inspect valve and cylinder head for damage. Using a new valve seat gasket, tighten valve cover, then valve clamp screw.
PISTON HITTING CYLINDER HEAD	Remove booster cylinder head and inspect for foreign material on piston top. Adjust piston to proper cylinder head clearance. Replace using new gaskets.

Table 5: Troubleshooting

LOW OR NO OIL PRESSURE

PROBABLE CAUSE	SUGGESTED REMEDY
LOW OIL LEVEL	Fill crankcase to full mark.
CLOGGED OIL STRAINER	Remove and clean oil strainer.
DEFECTIVE OIL PRESSURE REGULATING VALVE	DS033, DS044, DS060, DS081, and DS087: Remove regulating valve adjusting screw, spring, and ball. Check for weak or broken spring or damaged seat. Replace or repair as necessary. DS133, DS192, and DS303: Remove oil pump and inspect regulating valve plate, spring, and seat. Replace or repair damaged parts as necessary.
WORN OUT OIL PUMP	Replace oil pump.
OIL PUMP SUCKING AIR DUE TO GASKET FAILURE	Check gasket or seal in oil pickup line. Replace as necessary.
DEFECTIVE OIL PRESSURE GAUGE	Check gauge and replace as necessary.
INCORRECT FLYWHEEL ROTATION	Check that the flywheel fan is clockwise when viewed from the oil pump end. If not, check with a competent electrician to see if the motor rotation can be changed by reconnecting the motor leads.
LOW OIL PRESSURE SETPOINT IS TOO HIGH	Check low oil pressure setpoint and adjust if necessary.
LOW OIL PRESSURE FAULT DELAY SETPOINT TIME IS TOO SHORT	Adjust low oil pressure fault delay setupoint to be longer.
OIL PUMP PRESSURE IS NOT CORRECTLY ADJUSTED	Adjust the oil pump pressure.
OIL PRESSURE SYSTEM RESTRICTION	Check oil pickup screen in crankcase for blockage. Remove and clean if necessary.
OIL PUMP AIR LEAK	Replace oil pump O-ring and/or gerotor.
OIL PUMP SUCKING AIR DUE TO GASKET FAILURE	Check gasket or seal in oil pickup line. Replace as needed.

MOTOR OVERLOAD

PROBABLE CAUSE	SUGGESTED REMEDY
FAULTY WIRING TO PLC OR MOTOR	Check motor wiring for tight connections and proper wire size. Check PLC wiring connections to the input.
MECHANICAL BINDING	Disconnect motor from booster by removing v-belts and rotate the booster to check for binding.
EXCESSIVE DISCHARGE PRESSURE	Ensure high discharge pressure setpiont is correct.

Table 5: Troubleshooting (Continued)

HIGH DISCHARGE TEMPERATURE

PROBABLE CAUSE	SUGGESTED REMEDY
DIRTY COOLING SURFACES	Clean the cooling surfaces of the cylinder head, cylinders, intercooler, and after cooler.
INADEQUATE VENTILATION	Relocate the booster to a more suitable area having clean, dry, cool air with good ventilation. Air-cooled boosters should not be located in hot or high humidity areas.
LEAKING SECOND STAGE VALVES CAUSING HIGH FIRST STAGE AIR PRESSURES	Check for leaking valves or valve gaskets on second stage. Correct as necessary.
RESTRICTED AIR LINES	Check discharge piping and intercooler for damage to lines causing restriction in air flow.
HIGH DISCHARGE TEMPERATURE TOO LOW	Adjust high discharge temperature setpoint to be higher.
LOW SUCTION PRESSURE	Increase suction unload setpoint. Ensure specified suction pressure is available at the booster inlet.
FAULTY TEMPERATURE SENSOR	Check temperature sensor and wiring between the PLC and the temperature sensor. Replace if needed.

EXCESSIVE V-BELT WEAR

PROBABLE CAUSE	SUGGESTED REMEDY
PULLEY NOT PROPERLY ALIGNED	Realign motor pulley with the booster flywheel.
BELT TOO TIGHT OR TOO LOOSE	Adjust belt tension per Table 10 in SECTION 5, BOOSTER SERVICING.
PULLEY WOBBLE	Check for bent pulley, flywheel, or shafts.

USER DEFINED FAULT

PROBABLE CAUSE	SUGGESTED REMEDY
JUMPER J6 HAS BEEN REMOVED OR THE WIRING IS LOOSE	Inspect jumper J6 for removed, loose, or damaged wire.
A USER FAULT SHUTDOWN HAS BEEN WIRED INTO THE SYSTEM AND THE FAULT IS NOW ACTIVE	Inspect user shutdown signal to the PLC. Inspect wiring between the PLC and user fault shutdown. The PLC is looking for a high signal indicating no fault.

HIGH SUCTION PRESSURE

PROBABLE CAUSE	SUGGESTED REMEDY
HIGH SUCTION PRESSURE SETPOINT IS TOO LOW	Adjust high suction pressure setpoint to be higher.
SUCTION GAS PRESSURE SUPPLYING THE BOOSTER HAS RISEN ABOVE THE FAULT SETTING	Regulate the suction gas pressure coming into the booster.

Table 5: Troubleshooting (Continued)

LOW SUCTION PRESSURE

PROBABLE CAUSE	SUGGESTED REMEDY
LOW SUCTION PRESSURE SETPOINT IS TOO HIGH	Adjust low suction pressure setpoint to be lower.
INSUFFICIENT SUCTION GAS PRESSURE SUPPLY TO THE BOOSTER	Increase suction supply pressure.
RESTRICTION IN SUCTION PIPING	Check for obstructions in the suction piping.
VALVE UNLOADERS ARE NOT FUNCTIONING	With the booster running, disconnect the tubing to the valve unloader on the cylinder head. If air does not escape but the booster continues to run partially or completely unloaded, remove the unloader assemblies and valves and inspect.

HIGH DISCHARGE PRESSURE

PROBABLE CAUSE	SUGGESTED REMEDY
HIGH DISCHARGE PRESSURE SETPOINT IS TOO LOW	Adjust high discharge pressure setpoint to be higher.
BOOSTER FAILS TO UNLOAD	Check the unloader system. If system has unloader towers, ensure sufficient air is supplied to control valve.
PLUMBING RESTRICTION	Remove plumbing downstream of the booster and visually inspect for restrictions.
A DOWNSTREAM VALVE IS CLOSED	Check for a closed-off valve.

LOSS OF PRESSURE SIGNAL

PROBABLE CAUSE	SUGGESTED REMEDY
FAULTY PRESSURE TRANSMITTER	Check the transmitter electrical signal at 0 psi. It should read around 4.0 MA. If it is less than 2.0 MA, replace the transmitter.
THE WIRING BETWEEN THE PLC AND TRANSMITTER IS DAMAGED OR BROKEN	Check for damaged or loose wiring between the transmitter and the PLC.
THE WIRING BETWEEN THE PLC AND THE TRANSMITTER HAS INDUCED NOISE	Make sure the transmitter wiring has shielding and that the shielding is grounded only at the control panel.

LOSS OF TEMPERATURE SIGNAL

PROBABLE CAUSE	SUGGESTED REMEDY
FAULTY TEMPERATURE TRANSMITTER	Check the transmitter electrical signal at 0 psi. It should read around 4.0 MA. If it is less than 2.0 MA, replace the transmitter.
THE WIRING BETWEEN THE PLC AND TRANSMITTER IS DAMAGED OR BROKEN	Check for damaged or loose wiring between the transmitter and the PLC.
THE WIRING BETWEEN THE PLC AND THE TRANSMITTER HAS INDUCED NOISE	Make sure the transmitter wiring has shielding and that the shielding is grounded only at the control panel.

Table 5: Troubleshooting (Continued)

VALVE FAULT OPEN OR CLOSE (OPTIONAL FEATURE)

PROBABLE CAUSE	SUGGESTED REMEDY
THE VALVE POSITION SWITCH IS DAMAGED	Visually check the valve position switch for damage. Replace as needed.
THE VALVE POSITION IS NOT ADJUSTED CORRECTLY	Adjust the valve position switch so that it reads the position of the valve correctly.
THE VALVE IS STICKING AND EITHER NOT OPENING OR NOT CLOSING QUICK ENOUGH	Watch the valve to see if it is changing positions, and if it does so quickly. If the valve is sticking or operating slowly, repair or replace as needed.
THE WIRING BETWEEN THE VALVE AND THE POSITION SWITCH AND THE PLC IS DAMAGED OR INCORRECT	Check for damaged or loose wiring between the switch and PLC.

P001: PLC COM TIME OUT

PROBABLE CAUSE	SUGGESTED REMEDY
A TIMEOUT OCCURED AFTER SENDING A REQUEST TO THE PLC	Check the cable between the PLC and HMI for tight connections. Check for corroded connections on the HMI and PLC. If the cable connections are okay, contact Hycomp for support.

P023: NOT CONNECTED

PROBABLE CAUSE	SUGGESTED REMEDY
CABLE NOT CONNECTED PROPERLY	Connect cable and ensure that all connections are tight.
CABLE IS DAMAGED	Replace cable.
HMI OR PLC CONNECTIONS ARE CORRODED	Replace HMI or PLC depending on which connection is corroded.

P028: NO RESPONSE

PROBABLE CAUSE	SUGGESTED REMEDY
PLC FAILED TO RESPOND	Contact Hycomp for support.

PLC-001: PLC COMMUNICATION TIMED OUT

PROBABLE CAUSE	SUGGESTED REMEDY
HMI CABLE IS NOT CONNECTED OR CONNECTIONS ARE LOOSE TO THE HMI OR PLC	Connect cable and ensure that all connections are tight.
CABLE IS DAMAGED	Replace cable.
HMI OR PLC CONNECTIONS ARE CORRODED	Replace HMI or PLC depending on which connection is corroded.

Table 5: Troubleshooting (Continued)

PLC-023: CABLE NOT CONNECTED PROPERLY

PROBABLE CAUSE	SUGGESTED REMEDY
HMI CABLE IS NOT CONNECTED OR CONNECTIONS ARE LOOSE TO THE HMI OR PLC	Connect cable and ensure that all connections are tight.
CABLE IS DAMAGED	Replace cable.
HMI OR PLC CONNECTIONS ARE CORRODED	Replace HMI or PLC depending on which connection is corroded.

PLC-026: PLC CONNECTION TIME OUT

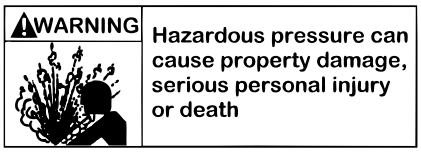
PROBABLE CAUSE	SUGGESTED REMEDY
A TIMEOUT OCCURED AFTER SENDING A REQUEST TO THE PLC	Check the cable between the PLC and HMI for tight connections. Check for corroded connections on the HMI and PLC. If the cable connections are okay, contact Hycomp for support.

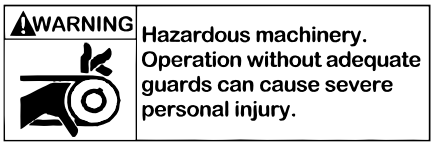
PLC-028: PLC FAILED TOP RESPOND

PROBABLE CAUSE	SUGGESTED REMEDY
THE PLC FAILED TO RESOND AFTER A REQUREST WAS SENT	Check the cable between the PLC and HMI for tight connections. Check for corroded connections on the HMI and PLC. If the cable connections are okay, contact Hycomp for support.

Table 5: Troubleshooting (Continued)

SECTION 5 BOOSTER SERVICING





NOTICE: Hycomp booster service and maintenance shall only be performed by qualified technicians. Service and maintenance shall conform to all applicable local and national regulations and safety standards.

WARNING: Never assume a booster is safe to work on just because it is not operating. It could restart at any time. The following procedures should be used when stopping to maintain or service a booster.

1. Per OSHA regulation 1910.147: *The Control of Hazardous Energy Source* (lockout/tagout), disconnect and lockout the main power source. Display a sign in clear view at the main power switch stating that the booster is being serviced.

2. Isolate the booster from the compressed air supply by closing any manual shut-off valves upstream and downstream from the booster. Display signs in clear view at the shut-off valves stating that the booster is being serviced.

3. Lock open a pressure relief valve within the pressurized system to allow the system to completely de-pressurize.

4. Shut off the cooling supply (where applicable).

5. Open all drain valves within the area to be serviced.

6. Wait for the unit to cool before servicing. Temperatures above 120°F can cause burns to the skin.

Refer to the proper Odyssey booster parts list to assist with disassembly, reassembly, and torque specifications. This section is a general guide to servicing Odyssey boosters. It is not meant to replace proper training and common sense.

TORQUE VALUES

Each booster parts manual lists the torque values required for each bolt within the booster. Torque values are DRY. The use of lubricant on the bolt threads will cause the bolt pre-tension value to be greatly higher and may lead to bolt failure. Table 7 is supplied as a guideline only for use where a torque setting is not given. The table is not meant to replace researching the proper torque value for the application.

TOOL LIST FOR SERVICING

A list of tools needed to service Hycomp boosters is included in Appendix 1. This is a fairly comprehensive list, but site conditions may require additional tooling not listed here.

CLEARANCES AND TOLERANCES

Clearances and tolerances are given on the following pages for various conditions and boosters. If additional information is required, please contact the factory.

Thread Sizes	Hex Head Grade 5 Dry Torque Values (ft-lb)
1/4-20	6 - 8
5/16-18	13 - 17
3/8 - 16	24 - 30
1/2 - 13	60 - 75
5/8 - 11	120 - 150
3/4 - 10	210 - 260
7/8 - 9	320 - 400
1 - 8	460 - 580

Table 6: General Bolt Torque Specifications for Grade 5 Cap Screws

Crankshaft end play	0.002 loose to 0.003 interference
Oil pump end clearance (ring & rotor)	0.001 to 0.003
Piston rod diameter	0.8735 to 0.8755
Cylinder bore diameter (under 1.50”)	0.0015 maximum over nominal
Cylinder bore diameter (1.50” - 3.00”)	0.003 maximum over nominal
Cylinder bore diameter (3.25” - 7.50”)	0.005 maximum over nominal
Cylinder bore diameter (over 7.50”)	0.006 maximum over nominal
HM Compression Ring radial thickness	*Contact factory
HN Guide Ring radial thickness	*Contact factory
Compression cylinder wall surface finish	12-16 RMS
Guide cylinder wall surface finish	12-18 RMS

*HM and HN style piston rings are available in a wide variety of materials and designs. Contact the factory if you are unsure if your rings need to be replaced.

Table 7: General Clearances and Tolerances
For all boosters, measured in inches.

MODEL	MINIMUM CLEARANCE
DS015, DS026	0.045
DS033, DS044	0.050
DS060, DS087	0.055
DS081	0.060
DS0133, DS192, DS303	0.070

Table 8: Compression Piston to Head Clearances

Measured in inches, between top of compression piston and top of cylinder head gasket. Values shown are minimums, Tolerances +0.015/-0.0. Refer to specific booster parts manual for model block designation.

Model	Rod Bearing Clearance	Crosshead Piston Clearance	Crosshead Piston Diameter	Crank Pin Diameter	Wrist Pin Bushing Clearance	Wrist Pin Diameter
DS015, DS026	0.0015 to 0.0025	0.003 to 0.004	2.9960 to 2.9930	1.7500 to 1.7505	0.0003 to 0.0006	0.8745 to 0.8755
DS033, DS044	0.0015 to 0.0030	0.003 to 0.004	2.9960 to 2.9930	1.7500 to 1.7505	0.0003 to 0.0006	0.8745 to 0.8755
DS060, DS087	0.0020 to 0.0035	0.003 to 0.004	2.9960 to 2.9930	2.2475 to 2.2485	0.0003 to 0.0006	0.8745 to 0.8755
DS081	0.0020 to 0.0035	0.0035 to 0.0050	3.9929 to 3.9950	2.2475 to 2.2485	0.0004 to 0.0008	1.1240 to 1.1255
DS0133, DS192, DS303	0.0025 to 0.0040	0.0045 to 0.0060	4.9925 to 4.9950	3.2509 to 3.2519	0.0005 to 0.0010	2.0000 to 2.002

Table 9: Crankcase and Crosshead Clearances and Tolerances

Measured in inches. Refer to specific booster parts manual for model block designation.

BOOSTER DISASSEMBLY

WARNING: Before starting work on the booster, all pressure must be bled off from both the first and second stages, including suction and discharge.

This is only a general outline of how to disassemble a Hycomp booster. Certain specifics may apply to your booster that are not listed here. Contact an authorized distributor or the factory for assistance on disassembling your booster.

CYLINDER HEAD AND COMPRESSION CYLINDER

1. Remove all process piping, unloader tubing, and instrumentation connected to the booster.

2. Remove unloader towers (if applicable) and valve clamp screw nuts.

3. Remove valve covers.

4. Remove unloader components (if applicable) and valve clamp components.

   a. Unloader components should be grouped as removed. Unloader pistons are adjusted to match with their associated parts.

5. Remove valve assemblies from valve pockets. Remove valve seat gaskets from valve pockets.

6. Unbolt and remove the booster heads.

7. Unbolt and remove the compression cylinders. Use suitable lifting equipment as necessary, being careful that the cylinders are lifted vertically until it clears the pistons, and that it does not cock and thereby damage the pistons or rings.

8. Remove all piston rings. Make note of ring location and orientation if rings are to be re-installed. Rings must be re-installed into the same location from which they were removed.

9. Install special rod clamping tool to hold the piston rod from rotating while removing the bolt/nut securing the compression piston. The piston rod must not be allowed to rotate during disassembly process.

10. Using an adequate heat source such as a hand torch, heat the piston rod just below the compression piston to a temperature just below 400°F. This will soften the Loctite so that the rod bolt can be loosened without galling the threads or disturbing the opposite end rod bolt integrity. Wear gloves so as not to burn yourself on the piston or rod. Be careful not to allow the rod to get so hot as to discolor it. A Tempil stick or other temperature measuring device should be used to get appropriate temperatures.

PLENUM CHAMBER

11. Odyssey boosters incorporate a ‘Plenum’ chamber between the compression cylinder and the crosshead guide cylinder. The plenum chamber can be removed with the piston rod packing case still attached by removing the bolts that hold the plenum to the crosshead cylinder and sliding the plenum chamber up the rods.

12. To remove the piston rod gas packing case, remove the four screws per case and push the case out the bottom of the plenum. The case is sealed to the plenum with an O-ring and may resist removal. If this is the case, jacking screw ports are provided in the bottom case flange. Use the bolts that were removed from this flange to jack it out of the plenum case.

13. Gas packings can be removed from the gas packing case by removal of the packing case cover. Attention should be given to the specific orientation of the gas packings and spring for re-assembly.

CROSSHEAD GUIDE CYLINDER

14. Remove the oil packing box cover from the oil packing box. Remove the oil packings. Remove the oil packing box from the crosshead guide cylinder. Discard old O-rings.

15. Remove the crosshead guide cylinder cap screws. Rotate the flywheel so that one crosshead piston is up and one is down. Lift the crosshead guide cylinder from the crankcase. Do NOT allow the crosshead pistons to fall against the side of the crankcase as this will damage them.

CROSSHEAD PISTONS AND CONNECTING RODS

16. Remove the crankcase inspection cover(s).

17. Remove the locknuts from the connecting rod bolts. It is best to only loosen the locknuts a few turns on both sides evenly, and to then loosen the connecting rod cap by blocking the guide piston on top of the crankcase and rotating the flywheel to cause the crankshaft to push against the connecting rod cap. This procedure will keep the connecting rod cap from jamming on the connecting rod bolts and being damaged.

18. Carefully lift the crosshead piston, piston rod, and connecting rod assembly out of the crankcase. Keep the connecting rod cap matched with the connecting rod/crosshead assembly. Each cap and connecting rod is marked with a dot or number on one side so they can be properly realigned during assembly. The connecting rod parts are not interchangeable and must be reassembled with the same mating parts. Work on only one connecting rod at a time to avoid confusion.

19. Remove piston rod set screw from the crosshead piston. Carefully use a drill bit to remove the burr created on the piston rod threads by the set screw. Failure to remove burr can result in damage to the piston rod and the crosshead piston.

20. Remove both piston rod clamp screws from the crosshead piston.

21. Remove both snap rings from the guide piston.

22. Heat crosshead piston evenly with a hand torch to facilitate removal of the wrist pin. Wrist pin can be pushed out of piston. Heat evenly to avoid overheating and warpage. Do not attempt to press out the wrist-pin.

23. Repeat this procedure for the second assembly.

24. Bronze wrist pin bushings can be pressed out of the connecting rod and new ones pressed in and honed before use. Roller bearings can be removed by heating the connecting rod end until the bearings slide out.

25. If the crankshaft bearings, crankshaft, or oil pump must be replaced, refer to the next section titled “Oil Pump Replacement” or the following “Bearing Replacement.”

OIL PUMP REPLACEMENT

1. Remove oil pressure gauge and oil pressure transducer.

DS033, DS044, DS060, DS081, and DS087

a. Remove the hex head cap screws fastening the oil pump cover to the bearing carrier. Remove the oil pump cover.

b. Check the rotor to cover clearance. There should be 0.001-0.003 inches of clearance. Replace rotor/shaft/gear assembly or oil pump cover if necessary.

c. Support crankshaft in the crankcase to prevent damage during removal.

d. Remove the hex head cap screws fastening the bearing carrier to the crankcase. Remove the bearing carrier from the crankcase.

e. Remove the O-ring from the oil pump shaft and slide the shaft/gear assembly through the bearing carrier bushing. Install new shaft/gear assembly in bearing carrier and replace O-ring. Replace outer rotor in oil pump cover. Place a few drops of oil or grease in the oil pump cover to lubricate at startup.

f. With the oil pump drive shaft assembly in the bearing carrier, set the oil pump shaft so that the slot in the shaft aligns with the drive pin in the crankshaft when the bearing carrier is mounted to the crankshaft. Replace the bearing carrier gasket, mount the carrier to the crankcase, and install bolts by hand. Rotate the oil pump drive shaft by hand until it is aligned with the drive pin on the crankshaft and the bearing carrier draws flush to the crankcase. Torque bolts to proper specification.

f. Set the new oil pump cover O-ring into the recess of the carrier and set the oil pump cover into the recess. Be sure the cover is rotated so the rotational

direction arrow is pointing in the same direction as the flywheel rotation. See the “Oil Pump Direction of Rotation” section in the Operation portion of this manual for more information. Hand-tighten the six oil pump cover bolts. If the oil pump cover cannot be drawn flush with the bearing carrier, the rotor/gear or housing/bearing carrier are misaligned. DO NOT tighten with a wrench. Remove and inspect.

g. Torque all bolts to proper specification.

DS133, DS192, and DS303:

a. Remove the hex head cap screws fastening the oil pump to the carrier. Carefully remove the oil pump.

b. Check rotor to housing clearance. There should be 0.001-0.003 inches of clearance. Replace rotor/shaft/gear assembly or housing if necessary.

d. Replace oil pump shaft O-ring and oil pump housing O-ring.

e. Set the oil pump shaft so that the slot in the shaft aligns with the drive pin in the crankshaft when the oil pump is mounted to the bearing carrier. Mount the oil pump to the carrier (aligned with dowel pins) and install bolts. Torque to appropriate level.

ALL MODELS:

2. Wrap all pressure fittings with fresh Teflon tape before reattaching.

3. Replace pressure gauge and oil pressure transducer.

DS015, DS026, DS033, DS044, DS060, DS081, and DS087: Adjust oil pressure regulating screw all the way in and back out 1.5 turns.

4. Pressurize unloader assembly so the machine will start without load.

5. Start the booster paying close attention to oil pressure. If pressure doesn’t rise to 20 PSIG for DS033, DS044, DS060, DS081, and DS087 or 40-50 PSIG for DS133, DS192, and DS303 within 30 seconds, shut the unit down and inspect for leaks.

6. Check oil pressure when machine is hot to be assured the pressure range is between 20-25 PSIG for DS033, DS044, DS060, DS081, and DS087, or 45-50 PSIG for DS133, DS192, and DS303. Adjust oil pressure as needed to obtain proper operation.

BEARING REPLACEMENT

NOTICE: When replacing the bearings, the entire bearing assembly including the cup and cone, must be replaced as well as the oil seal if applicable.

1. Follow steps of the “Booster Disassembly” section.

2. Remove the flywheel and drive key from the crankshaft.

3. Support crankshaft in the crankcase to prevent damage during removal.

4. Remove the oil pump and/or bearing carrier per the “Oil Pump Replacement” section.

5. Remove the bearing cup from the bearing carrier using a bearing puller.

6. Slide the crankshaft through the oil-pump end of the crankcase. The bearing cones can be removed from the crankshaft with a bearing puller.

7. Remove the bearing cover plate from the flywheel end of the crankcase. The bearing cup is pressed into the crankcase and must be removed with a bearing puller. Remove all shims from the bearing cover plate and crankcase.

8. Grease the outer edges of the new bearing cups. Press the flywheel end bearing cup into the crankcase with the large end of the taper away from you (towards oil pump). Press until the cup is flush with the outside of the crankcase. Press the oil pump end bearing cup into the bearing carrier with the larger end of the taper away from the bearing carrier (toward you) until it stops.

9. Press the proper bearing cone onto each end of the crankshaft with the larger end of the taper towards the center of the crankshaft. The bearing races should rest against the crankshaft shoulder. Lubricate the bearing cones thoroughly with clean, high quality grease.

10. Install the crankshaft through the oil pump end of the crankcase.

11. Install the bearing carrier onto the crankcase with a new bearing carrier gasket. Tighten bolts to specified torque.

12. If the bearings have not been replaced, reinstall the flywheel end bearing plate and the same shims. If new bearings have been installed, use a thicker set of shims. Torque the bearing cover plate bolts to proper tightness.

13. Rotate the crankshaft by hand to be sure it is free to spin. Verify the proper amount of end play of the crankshaft per Tables 7, 8, and 9. If necessary, remove shims until end play is within tolerance.

14. If the crankshaft binds, or there is no end play, remove the bearing carrier, crankshaft, and bearing

plate and drive the flywheel end bearing cone slightly farther out of the crankcase. Re-install the bearing carrier and crankshaft and put thicker shims in front of the bearing plate. Replace the bearing plate and torque to proper tightness. Repeat step 12-13 until bearing play is within tolerance.

15. Reinstall the oil pump or oil pump cover per “Oil Pump Replacement.”

BOOSTER ASSEMBLY

This is only a general outline of how to assemble a Hycomp booster. Certain specifics may apply to your booster that are not listed here. Contact an authorized distributor or the factory for assistance on assembling your booster.

Booster assembly is generally the opposite of booster disassembly. Before assembling, clean all parts thoroughly and check surfaces for burrs, nicks, dings, or excessive wear patterns. Replace all O-rings and gaskets that were removed during disassembly.

Specific booster parts manual is to be referred to for component identification. Assembly fastener notes and tightening torque values are contained in the specific booster parts manual. Required special tools are referenced in the booster parts manual. All O-rings are to be installed using a minimum amount of O-ring lubricant. Threaded pipe connections are to be sealed using an appropriate application of Teflon thread seal tape. No pipe thread dope is to be used.

CONNECTING ROD AND CROSSHEAD PISTON

NOTICE: When replacing one crosshead piston or connecting rod, the new part and remaining part must both have the same part number. Differences may lead to unbalanced conditions and excessive vibration.

1. To replace wrist pin bushings in connecting rod, press the new bushing into the connecting rod and hone to proper diameter. The side of the bearing with the part number stamped on it should face out. The bearings should go in until they are just flush with the outside of the connecting rod. Do not put bearings in too far as they will block flow from the oil passage through the center of the connecting rod. Liberally grease bearings or bushing with an appropriate assembly grease.

2. Replace one snap ring into crosshead piston. Heat the crosshead piston evenly to approximately 400ºF until the wrist pin slides easily into piston. Slide the connecting rod into bottom of crosshead piston until bearing/bushing is aligned with wrist pin. Allow wrist pin to slide through connecting rod and into other end of the crosshead piston. Put the second snap ring in place. Allow the assembly to cool. Repeat with second assembly. NOTE: On models DS033 and DS044, wrist pin oil journal port must be aligned with oil journal in the connecting rod.

3. After connecting rod and crosshead assembly have cooled, place the split bearing halves into the connecting rod halves, aligning the bearing tang with the grooves in the connecting rod. Liberally coat the bearing faces with grease.

4. Set the top of the connecting rod/crosshead assembly over the crankshaft journal. Replace the proper connecting rod cap, aligning the dots or numbers on the connecting rod and cap so they are both on the same side. Start the nuts onto the connecting rod bolts. Install the nuts evenly to pull the cap into place and torque to proper tightness. Repeat with second assembly. Do not allow crosshead piston to fall against crankcase as this may damage the piston.

5. Reinstall piston rods into crosshead piston. Screw piston rod all the way into crosshead piston and back out 3 full turns. The crosshead piston has locking threads, so expect some resistance.

CROSSHEAD GUIDE

6. Replace the crosshead to crankcase gasket with a new one.

7. Coat the inside of the crosshead guide cylinder with oil. Lightly grease the outside of the crosshead pistons.

8. Set the crosshead guide cylinder over the crosshead pistons and slowly lower onto crankcase. Make certain the crosshead guide pistons are started straight into the bores of the crosshead guide cylinder to prevent damage. Use the piston rods to align the crosshead pistons into the cylinder bores. Set crosshead guide cylinder onto crankcase and tighten bolts to torque.

9. Replace the oil scraper box and add new O-rings. Hand-tighten bolts. Slide the oil packings down the piston rod, being certain not to damage the packing face or inner diameter. Use special packing piston rod tool to install oil scrapers. Replace oil scraper box cover and tighten bolts to torque.

10. Fill the crankcase with the proper amount of oil. Squirt oil onto the crankshaft bearings and connecting rod bearings.

11. Re-install crankcase inspection plate with new gaskets. Apply RTV silicone to seal gaskets. Tighten fasteners to proper torque.

12. Rotate the crankshaft a few times and then tighten

crosshead guide cylinder cap screws to proper torque. Rotate crankshaft again to insure smooth movement.

NOTE: Do not tighten the oil scraper box mounting bolts at this time.

PLENUM CHAMBER AND GAS PACKING CASE

Pre-assemble the gas packing case(s), ensuring correct orientation of the gas packings (see diagram that comes with new gas packings). Install a new O-ring on the gas packing case, using a minimum of compatible O-ring lubricant. Insert the case(s) into the plenum chamber and tighten bolts to specified torque.

Rotate the crankshaft so one piston rod is at top dead center (the other will be at bottom dead center). Install tool (packing install tool) onto the top of the highest rod. Orient the plenum chamber so the dowel pins align and carefully lower the plenum down the piston rods. Once the first set of gas packings is past the top of the rod, remove the install tool and place on the other rod. Finish lowering the plenum down to the crosshead cylinder. Tighten bolts to specified torque.

COMPRESSION CYLINDER AND PISTONS

12. Install plenum adaptor plate (if applicable).

13. Install compression piston onto top of piston rod. NOTE: Two stage booster models require confirmation of specific piston placement.

a. Install piston rod clamping tool near to underside of piston. Secure compression piston to piston rod per instruction in specific model parts manual. Repeat for second piston rod if applicable.

b. Install piston rings by staggering ring gaps 90° apart from each other. Rings are supplied in matched pair sets. Care must be taken to install in correct pairs. Ring location and quantities per specific model parts manual. Repeat for second piston if applicable.

14. Install compression cylinders.

a. Slide cylinder over piston and rings, manually compressing rings into cylinder bore, taking care not to damage ring material.

b. Tighten cylinder mounting bolts to proper torque.

15. Measure top of piston to top of cylinder to determine proper piston clearance. NOTE: Recommend completing this procedure completely on one cylinder before beginning process on second cylinder.

a. Rotate flywheel to raise piston to top dead center position.

b. Measurement is taken between the top of the compression piston and the cylinder top surface adjacent to the bore. Dial indicator gauge is to be zeroed at the cylinder top surface immediately adjacent to cylinder bore. Recommend taking multiple measurements at locations around the cylinder.

c. See Table 7 for minimum clearance value.

d. Rotate piston rod in crosshead piston to achieve correct clearance measurement.

e. Remove finger tight bolts from oil scraper case.

f. Raise oil scraper case to provide access to top of crosshead piston.

g. Tighten two clamp bolts to specified torque prior to tightening the set screw. Special tool is required to access clamp bolts for tightening.

h. Lower oil scraper case into final position and secure.

i. Repeat piston clearance adjustment steps for second cylinder.

CYLINDER HEAD

If the valve assemblies must be removed from the cylinder head, refer to the “Valve Replacement” section.

16. Center bolts that pass through air passages on DS033, DS044, DS060, DS081, and DS087 must have a copper bolt gasket installed into the bolts.

17. Install center and outer head bolts as well as intercooler bolts. Tighten head bolts to snug, starting with center bolts and working outward. When done, retighten to one-half final torque and then to full torque.

18. Rotate the booster by hand to be certain it turns freely and the pistons are not hitting the cylinder head.

19. Follow all procedures listed in the “Booster Start-up” section.

VALVE REPLACEMENT

NOTICE: Suction and discharge valves must be installed in the correct cylinder head locations. To avoid confusion, work only on the inlet or the discharge valves at one time or tag the valves and valve pockets with a note to indicate suction or discharge.

NOTICE: It is critical that the valve hold-down screws be backed out when changing a valve, as the valve cover plate may crack if the new valve is

slightly taller than the previous valve and the valve cover plate is torqued to final tightness.

1. Unloaded Suction Valves

a. Remove unloader tubing from unloader towers.

b. Disassemble valve cover and associated components. Valve clamp screws must be removed from valve cover prior to re-installation of the valve cover.

c. Remove valve assembly and valve seat gasket.

d. Install new valve seat gasket, assuring proper placement in valve pocket.

e. Install new valve assembly. Confirm that correct valve assembly is installed in the proper valve pocket. Suction and discharge valves are the same diameter.

f. Install unloader assembly components as shown in parts manual. Install lower valve clamp with side opening in clamp oriented toward port in cylinder head.

g. Confirm that valve clamp screws are NOT in place in the valve cover prior to installation.

h. Install and fasten valve cover and secure to specified torque before installing valve clamp screws.

i. Unloader piston installation/adjustment is to be done in compliance with instructions on Form FR-02-008, Record 009 to achieve proper unloader assembly.

j. After unloader piston adjustment has been completed, secure valve clamp screws to specified torque.

k. Install unloader tower assembly and unloader tubing.

l. Manually rotate flywheel to insure there is no interference.

2. Discharge Valves and Non-Unloaded Suction Valves

a. Disassemble valve cover and associated components. Valve clamp screws must be removed from valve cover prior to re-installation of the valve cover.

b. Remove valve assembly and valve seat gasket.

c. Install new valve seat gasket, assuring proper placement in valve pocket.

d. Install new valve assembly. Confirm that correct valve assembly is installed in the proper valve pocket. Suction and discharge valves are the same diameter.

e. Confirm that valve clamp screws are NOT in place in the valve cover prior to installation.

f. Install and fasten valve cover and secure to specified torque before installing valve clamp screws.

g. After unloader piston adjustment has been completed, secure valve clamp screws to specified torque.

h. Install valve screw nut.

i. Manually rotate flywheel to insure there is no interference.

V-BELT TENSION AND ALIGNMENT SETTINGS

Improper pulley alignment and belt tension will cause motor overload, excessive vibration, and premature belt and bearing failure. The belt must be routinely inspected for cracks, burns, frays, or any unusual wear and replaced if necessary. Routinely check the motor sheave and booster flywheel for oil, grease, or burrs. Clean or replace when necessary. Make sure all mountings are securely fastened. The drive belt grooves of the sheave and flywheel must line up with each other. The motor drive shaft must be parallel to the booster crankshaft. Hycomp recommends banded belts rather than multiple individual belts.

Angular Misalignment - The motor shaft and booster crankshaft are not parallel. This is typically due to an alignment error at motor or motor adjusting base. Correct alignment by shifting the motor to bring the motor shaft parallel with the crankshaft (see Figure 37).

Parallel Misalignment - The sheave is not properly located on the motor shaft. This is typically caused by improper location of the motor drive sheave on the motor shaft. Loosen and reposition sheave until properly aligned with flywheel (see Figure 37).

Sheave Wobbling on Shaft - Sheave or bushing not installed on motor shaft correctly. **Note: Sheave alignment can be checked by using several methods. Alignment on v-belt drives should be less than 1/2˚ or 1/10" per foot of center to center distance.**

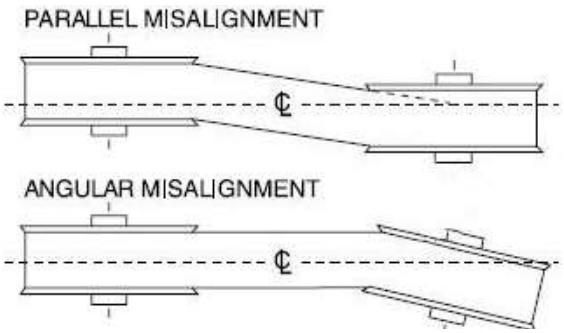


Figure 37: Misalignment

Straight Edge Method - This method can be used to align the motor sheave and booster flywheel.

1. Confirm that the booster, motor, and motor mount are squared up with the skid face and all mounting bolts are secure.

2. Install bushing and sheave on the motor shaft.

3. Place the belt(s) on the motor sheave and booster flywheel and temporarily tighten belt by adjusting the motor base mount. Note: Banded v-belts may need to be installed at the same time as the motor sheave for ease of assembly.

4. Place a straight edge across the face of the booster flywheel, spanning the motor sheave. An angular misalignment will be observed as an angle between the straight edge and the face of the motor sheave. A parallel misalignment will be observed as an offset between the center line of a belt on the flywheel and motor sheave. Resolve angular misalignment prior to making corrections in parallel misalignment, as angular corrections require repositioning of the motor.

Alignment Evaluation **- (See Figure 38)**
Angular Alignment: Place a straight edge across the booster flywheel with the loose end of the straight edge **not** in contact with the motor sheave. Observe alignment of the face of the motor sheave with the line of the straight edge. Adjustment of the motor and/or mounting base will be required to correct angular alignment.

Parallel Alignment - Place a straight edge across the booster flywheel with the loose end of the straight edge **not** in contact with the motor sheave. Measure from straight edge to a marked reference point on the belt at the flywheel. Rotate belt to shift the marked reference point at the motor sheave. Adjust sheave on motor shaft to obtain equal measurements.

Figure 38: Alignment Evaluation

The belt can now be tightened via the motor base, refer to specific v-belt manufacturer tension ratings. An example of deflection force tensioning follows:

Measure span length (t) (see Figure 39).

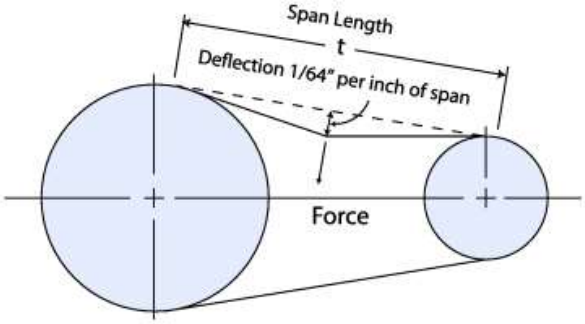


Figure 39: V-Belt Deflection Measurement

Using an appropriate sized v-belt tension gauge, on the scale reading “Deflection Inches”, set the O-ring to show a deflection of 1/64” per inch of span length (t). For example a span length of 32” will require a deflection of 32/64” or 1/2” (see Figure 40).

At the center of the span (t), apply force using the tension tester perpendicular to the span. For banded belts, place a piece of steel or angle iron across the band width and deflect the entire width of the band evenly.

Figure 40: Tension Gauge Example

Use the straight edge placed across the sheave and flywheel above the belt to establish a reference line. Deflect the belt until the bottom edge of the lower O-ring is at the correct deflection distance. Find the deflection force on the upper scale of the tension tester. The sliding rubber O-ring will move up the scale as the tester is compressed (see Figure 41).

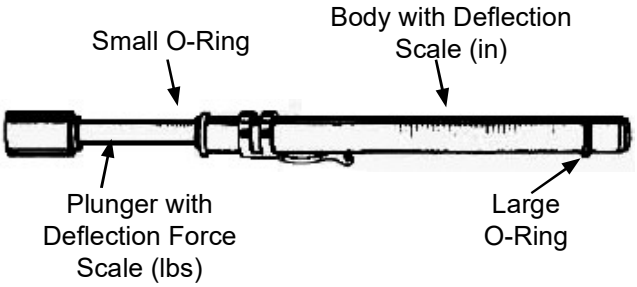


Figure 41: V-Belt Tension Gauge

Compare the deflection force with the range of forces recommended (see Table 10). If less than minimum the belt should be tightened. **Note: There normally will be a rapid drop in tension during the run in period and the belt must be inspected periodically to ensure the belt tension is within the specified range.**

For example if you have a 4B belt with a motor sheave of 5.4” diameter and a span of 32”, you would deflect the belt 32/64” (1/2”) from the reference line. At that amount of deflection the force applied should be 36.4 lbs. maximum. With new belts, start near the maximum deflection force value and check the tension periodically during the first 24 to 48 hours of service duty. You must adjust to run in the range of 24.8 lbs. to 36.4 lbs (see Table 10).

Care should be taken during tension adjustments to assure that the alignment is maintained.

Upon completion of alignment and tension adjustment, all mounting hardware should be re-checked for proper tightness.

V-Belt Cross Section	Small Sheave Diameter Range (in.)	Recommended Deflection Force (lbs.)	
		MIN.	MAX.
2B	4.6	10.2	14.8
	5.0 - 5.2	11.6	17
	5.4 - 5.6	12.4	18.2
	6.0 - 6.8	14.2	20
	7.4 - 9.4	16.2	24
3B	4.6	15.3	22.2
	5.0 - 5.2	17.4	25.5
	5.4 - 5.6	18.6	27.3
	6.0 - 6.8	21.3	30
	7.4 - 9.4	24.3	36
4B	4.6	20.4	29.6
	5.0 - 5.2	23.2	34
	5.4 - 5.6	24.8	36.4
	6.0 - 6.8	28.4	40
	7.4 - 9.4	32.4	48
4C	7.0	36.4	52
	7.5	38.8	56
	8.0 - 8.5	44	64
	9.0 - 10.5	48	72
	11.0 - 16.0	56	84

Table 10: Typical V-Belt Deflection Forces

APPENDIX 1 TOOL LIST

Hycomp booster assemblies utilize “English Customary Measurements” for sizing tools and specifying torque values, tolerances, and clearances.

Common tools and sizes suitable for Hycomp booster service include:

- Open end box wrench set 3/8” to 1-1/4”
- 12 point 1/2” drive socket set and ratchet 1/2” to 1-1/4”
- 6 point 1/4” drive socket set and ratchet 3/8” to 3/4”
- 1/4”, 3/8”, 1/2” socket drive extensions
- 1/2” drive torque wrench 20-150 ft-lb
- 3/8” drive torque wrench 5-80 ft-lb
- 6”, 8”, 12”, and 14” adjustable end wrench
- Flat head screwdriver assortment
- Phillips head screwdriver assortment
- Hex head wrench (Allen) assortment 5/32” to 3/8” (socket drive also suggested)
- Internal snap ring pliers
- Ball peen hammer
- Soft head mallet
- 6” or 8” Precision caliper (.0001 accuracy)
- Precision depth gauge dial indicator (.001 accuracy)
- V-belt gauge
- Gasket scraper tool
- 6” rule
- Flashlight
- Brass drift
- Propane torch
- Multimeter (w/temperature probe desirable)
- Ammeter
- Abrasive pad (ScotchBrite or similar)
- Oil free silicone O-ring lubricant
- Teflon pipe thread tape and Loctite 545 thread sealant
- High temperature silicone gasket sealer
- Thread locking compound (Loctite 242, 246, and 266)
- Pipe wrench and/or monkey wrench
- Pliers and diagonal cutter
- O-ring pick
- Lockout/Tagout set for secure power isolation
- “Short” 3/8” hex head (Allen) wrench - Required on some air-cooled cylinders to remove base fasteners.

See specific booster parts manual for required Hycomp special tools.

APPENDIX 2 BOOSTER STORAGE

If a booster is not to be put into service or is to be taken out of service for an extended length of time, the following procedures should be taken to prevent corrosion and deterioration.

1. Fill the crankcase with rust inhibiting oil. Squirt oil on the piston rods and crosshead pistons.

2. Loosen v-belts to relieve tension on the bearings.

3. Remove valves and place a bag of dust-free desiccant inside of each valve pocket. Store valves in a sealed plastic bag with desiccant in each bag. Plug all openings to booster. Place several bags of desiccant into crosshead area.

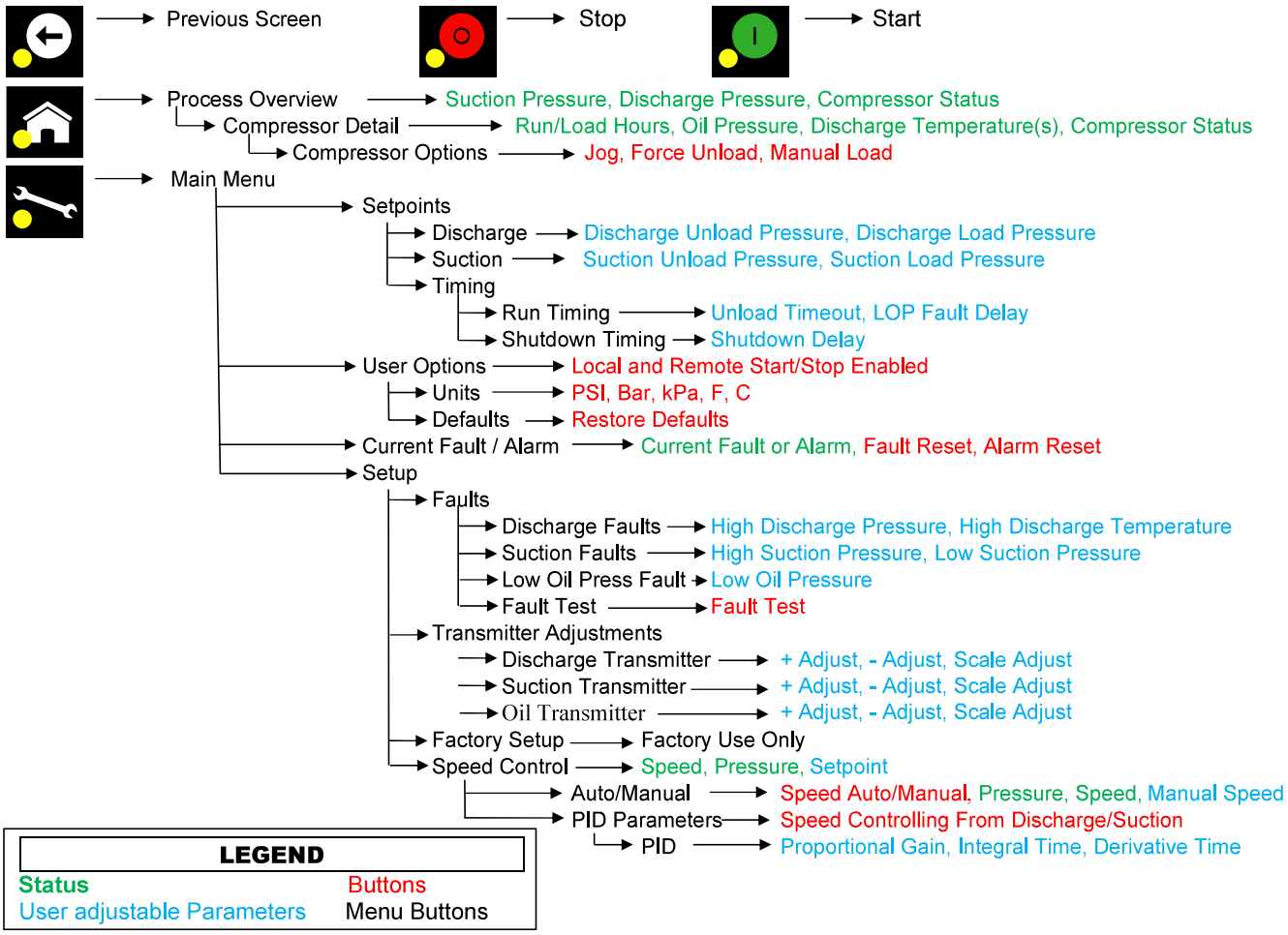
NOTICE: Tag the unit with a warning that the booster is partially disassembled. Copy the tag printed on this page.

4. Store the unit under plastic, off the ground. The box/pallet the unit came in is excellent storage container. Store the unit indoors.

5. When the booster is to be put into service, change the crankcase oil, remove any desiccant, and re-install valves. See the “Pre-Start-up Checklist” and “Start-up Procedure” sections in this manual.

NOTICE: BOOSTER IS PARTIALLY DISASSEMBLED AND MAY CONTAIN DESICCANT. CAREFULLY INSPECT VALVE POCKETS AND CROSSHEAD AND REMOVE ANY DESICCANT FOUND BEFORE RUNNING BOOSTER. REINSTALL REMOVED VALVES.

APPENDIX 3 SCREEN NAVIGATION CHART



APPENDIX 4 MODBUS GATEWAY

This appendix is applicable only if your Hycomp system is equipped with the optional Modbus Gateway. Please see the addendum at the beginning of this manual if you are not sure if your system includes the Modbus Gateway option.

The PLC has the ability to read and write Modbus TCP/IP. The purpose of the Modbus Gateway is to provide a means for network connectivity so Modbus registers can be accessed for the remote indication and control. The Modbus Gateway and PLC Serial port have been configured to the following settings:

Baud Rate: 9600
Parity: Odd
Stop Bits: 1

The Modbus Gateway has been configured to use an automatic DHCP connection when connected to your network (See figure 42). In order to access the Modbus Gateway, you will need to obtain the MAC address printed on the side of the unit, and determine the IP address it has been assigned by your network.

A list of Modbus registers is included in table 11 below.

Description	Data Type	Modbus Address+ Data Type	Modbus Address Only
ALARM RESET	Discrete	3192	3193
ALARM STATUS	Discrete	3193	3194
COMPRESSOR - JOG	Discrete	3176	3177
COMPRESSOR LOADED HOURMETER	32 BIT HEX BCD	1330	41331
COMPRESSOR LOADS PER HOUR	16 BIT HEX BCD	576	40577
COMPRESSOR LOADS TOTAL	32 BIT HEX BCD	560	40561
COMPRESSOR RUN HOURMETER	32 BIT HEX BCD	1328	41329
COMPRESSOR START PER HOUR	16 BIT HEX BCD	577	40578
COMPRESSOR STARTS TOTAL	32 BIT HEX BCD	568	40569
COMPRESSOR STATUS	16 BIT HEX BCD	1561	41562
COMPRESSOR - SHUTDOWN TIME SETPOINTS	16 BIT HEX BCD	1349	41350
DEFAULTS - DEFAULTS SETPOINTS RESTORED	Discrete	3078	3079
DEFAULTS - RESTORE DEFAULT SETPOINTS	Discrete	3181	3182
DISCHARGE PRESSURE	32 BIT HEX BCD	2378	42379
DISCHARGE PRESSURE + ADJUSTMENT	32 BIT HEX BCD	2402	42403
DISCHARGE PRESSURE - ADJUSTMENT	32 BIT HEX BCD	2452	42453
DISCHARGE PRESSURE SCALE ADJUSTMENT	16 BIT HEX BCD	1404	41405
DISCHARGE PRESSURE LOAD SETPOINT	32 BIT HEX BCD	2384	42385
DISCHARGE PRESSURE UNLOAD SETPOINT	32 BIT HEX BCD	2386	42387
DISCHARGE PRESSURE - HIGH DISCHARGE PRESSURE SETPOINT	32 BIT HEX BCD	2392	42393
DISCHARGE RTD	16 BIT HEX BCD	2496	42497
DISCHARGE RTD + ADJUSTMENT	16 BIT HEX BCD	1411	41412
DISCHARGE RTD - ADJUSTMENT	16 BIT HEX BCD	1412	41413
DISCHARGE RTD SCALE	16 BIT HEX BCD	1413	41414

APPENDIX 4 MODBUS GATEWAY

Description	Data Type	Modbus Address + Data Type	Modbus Address Only
DISCHARGE RTD - HIGH DISCHARGE TEMP SETPOINT	16 BIT HEX BCD	2498	42499
FAULT - ERROR MESSAGES	16 BIT HEX BCD	1536	41537
FAULT RESET	Discrete	3106	3107
FAULT STATUS	Discrete	3107	3108
FAULT TEST	Discrete	3105	3106
LOAD - FORCE UNLOAD	Discrete	3330	3331
LOAD - LOAD STATUS	16 BIT HEX BCD	1511	41512
LOAD - MANUAL LOAD	Discrete	3196	3197
LOAD - UNLOAD TIMEOUT	16 BIT HEX BCD	1344	41345
OIL PRESSURE	32 BIT HEX BCD	2382	42383
OIL PRESSURE + ADJUSTMENT	32 BIT HEX BCD	2408	42409
OIL PRESSURE - ADJUSTMENT	32 BIT HEX BCD	2460	42461
OIL PRESSURE SCALE ADJUSTMENT	16 BIT HEX BCD	1410	41411
OIL PRESSURE - LOW OIL PRESSURE (LOP) FAULT DELAY	16 BIT HEX BCD	1345	41346
OIL PRESSURE - LOW OIL PRESSURE (LOP) FAULT SETPOINT	32 BIT HEX BCD	2398	42399
SUCTION PRESSURE	32 BIT HEX BCD	2376	42377
SUCTION PRESSURE + ADJUSTMENT	32 BIT HEX BCD	2404	42405
SUCTION PRESSURE - ADJUSTMENT	32 BIT HEX BCD	2456	42457
SUCTION PRESSURE SCALE ADJUSTMENT	16 BIT HEX BCD	1407	41408
SUCTION PRESSURE LOAD SETPOINT	32 BIT HEX BCD	2388	42389
SUCTION PRESSURE UNLOAD SETPOINT	32 BIT HEX BCD	2390	42391
SUCTION PRESSURE - HIGH SUCTION PRESSURE SETPOINT	32 BIT HEX BCD	2394	42395
SUCTION PRESSURE - LOW SUCTION PRESSURE SETPOINT	32 BIT HEX BCD	2396	42397

Table 11: Modbus Registers

Figure 42: Modbus Customer Connection

Connect Your ethernet cable (white) to the proper port, as pictured to the left.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