

HYDRAULIC OPERATOR HS-2

RECEIVING INSTRUCTIONS

Handle with extreme care.

Please read the following instructions completely prior to commencing installation.

The equipment is a precision-engineered motor operator. Every effort has been made to properly prepare the equipment for shipment. To lift operator out of crate, attach rigging to the top of the aluminum support channel.

Carefully and thoroughly inspect this shipment.

It is absolutely necessary that any and all shipping loss or damage is reported to the local freight agent within fifteen (15) days of delivery. Please request an on-site agent inspection of the damages.

NOTE:

Failure to file a damage/loss claim within the specified period waives the right to supplier or carrier loss reimbursement. Do not accept damaged goods until the delivering driver has made a damage notation on the freight bill.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchasers purposes, the matter should be referred direct to the Turner Electric, LLC factory at 618-397-1865.

DESCRIPTION

The Turner Hydraulic Actuated Motor Operator (HAMO) model HS-2 is a variable speed, variable torque operator for use with airbreak disconnect switches. The modular unit can be utilized to operate a switch from remote locations and for automatic relay switching schemes.

OPERATION

The HS-2 power unit consist of a motor driven hydraulic pump, and manifold with restrictor valves and solenoid actuated valves. When activated, the pump builds fluid pressure to a specified pressure against a stored energy accumulator. When adequate pressure is obtained, a pressure sensitive switch energizes the close or open solenoid driven valves, allowing fluid to flow in the appropriate direction.

The switch operating speed is fully adjustable in the field. The three (3) cartridge valves located on the power unit manifold (see Fig. 1) control the fluid and therefore the speed of rotation as well as the torque output.

IMPORTANT:

Regardless if unit is installed on a new or existing switch, the disconnect switch should be completely and properly adjusted and operating satisfactorily prior to motor operator installation. If an existing switch, proper maintenance should be performed.

OPERATOR MECHANICAL INSTALLATION

NOTE: Use the aluminum support channel for lifting the motor operator.

- 1.0 Locate the required mounting heights for the operator. This would normally be at a height where an operating person can easily access the manual handle. Align operator power shaft with switch vertical operating pipe (VOP) with a level. Mount the HS-2 operator securely to the switch structure or pole with thru bolts and lag screws (see Fig. 2 and DWG. 7050A or appropriate drawing).
- 2.0 Cut off the vertical operating pipe (VOP) 11” from the top of the operator power shaft (see drawing).
- 3.0 The handle assembly is a two (2) piece unit consisting of a manual swing handle/locking assembly and a VOP four (4) piercing screw coupling. The unit is shipped assembled with the pipe coupling secured to the handle with hand-tightened piercing screws. To install the handle assembly:
 - 3.1 Remove the pipe coupling from the handle assembly and slide it up on the VOP. Orient the pipe coupling screws toward the mounting structure. Hand snug screws to hold the coupling in place.
 - 3.2 Place the handle assembly over the slotted power shaft.
 - 3.3 Align VOP and handle assembly. Loosen the pipe coupling and slide it down the handle.
 - 3.4 Raise the entire handle coupling assembly one inch (1”) above the power shaft bearing. Align handle tang with power shaft locking key - way (see Fig. 2). Tighten BUT DO NOT PIERCE down pipe coupling’s four (4) piercing screws.
 - 3.5 Insert the manual-operating swing handle in the cast handle socket. (NOTE: “J” slot in handle should engage a pin in the socket.) Confirm that the handle socket tang locks into the power shaft coupling key-way (see Fig. 3).
 - 3.6 Manually operate the switch and adjust the swing handle position to obtain equal handle travel on both sides of operator center line. Securely tighten piercing set screws and mark position of coupling to handle assembly. Remember that the switch operates 90 degrees—to open or close.
 - 3.7 The “lock down stops” are used to lock the switch in the open or closed position when the motor operator is disengaged from the VOP. Remove the swing handle and adjust the “lock down stops” in the open and close positions snug nuts.
 - 3.8 Pierce pipe coupling screws two (2) on vertical operating pipe, DO NOT PIERCE manual handle set screws.

IMPORTANT: Manual operation of the switch must be satisfactory prior to motorizing. Again check the switch to make sure all necessary adjustments for switch levers, reach rods, arcing horns, interrupters, etc. are correct. See appropriate switch installation instruction book for details.
 - 3.9 Complete battery cabinet AC & DC wiring. See wiring diagram for proper motor operator fuse block wiring. CONFIRM POLARITY.
- 4.0 OPEN and CLOSE CYCLE DESCRIPTION:

It is imperative that the installer fully understand the role and sequence of operation of the various devices in the HS-2. Please carefully review the following opening and closing description prior to energizing the equipment. Please note that units are shipped in a counter clockwise to close set up as standard. (Unless specified otherwise in the order). A tag on the manifold is marked accordingly. Confirm that the opening direction of the operator and the opening direction of the switch are identical. If not, reverse the unit per instructions at 20.

HYDRAULIC OPERATOR HS-2

HS-2 OPENING CYCLE DESCRIPTION (CW)

- 1) The switch is in the CCW closed position.
- 2) Cam 1 controls clockwise rotation is closed.
- 3) Cam 2 controls counter clockwise rotation.
- 4) Cam 3 controls the high speed close action is closed and will break at approximately 45 degrees.
- 5) Depress and hold local/remote push button and operate the toggle switch to open then release both switches. The circuit will seal in automatically.
- 6) The open relay and motor solenoid relay will make. The motor will start driving the pump.
- 7) The pressure gauge will immediately jump to approximately 825 psi, the nitrogen pre-charge level.
- 8) Oil will flow to the accumulator until approximately 1250 psi is indicated.
- 9) At approximately 1250 psi, the pressure switch will make and the start relay will make.
- 10) The open solenoid valve will open allowing oil to flow from the accumulator thru the open speed adjustment valve to the CW port of actuator.
- 11) Fluid will strike the valve of the actuator and it will rotate CW.
- 12) The speed of rotation can be increased or decreased by the opening speed adjustment valve. Screwing in the valve restrictors flow, screwing out will allow more fluid to flow.
- 13) Cam 2 will transfer after approximately 10 degrees rotation.
- 14) Cam 3 will transfer after approximately 45 degrees rotation -- NOTE: Cam 2 and 3 have no effect on this operation.
- 15) Actuator will rotate to the full open position.
- 16) At the full open position, Cam 1 will open and drop out entire circuit. Cam 2 will be made for next operation.

HS-2 CLOSING CYCLE DESCRIPTION (CCW)

- 1) The switch is in the CW open position.
- 2) Cam 2 controls clockwise rotation is closed.
- 3) Cam 1 controls counter-clockwise rotation is open.
- 4) Cam 3 controls the high speed close action is open and will make at approximately 45 degrees or one-half of total travel of switch, if so desired.
- 5) Depress and hold local/remote push button operate the toggle switch to close then release both switches. The circuit will seal in automatically.
- 6) The motor will start driving the pump. The close relay and motor solenoid relay will make.
- 7) The pressure gauge will immediately jump to approximately 825 psi, the nitrogen pre-charge level.
- 8) Oil will flow to the accumulator until approximately 1250 psi is indicated.
- 9) At approximately 1250 psi, the pressure switch will make and the start relay will make.
- 10) The close solenoid valve will open allowing oil to flow from the accumulator thru the slow-close adjustment valve to the CCW port of actuator.

- 11) Fluid will strike the vane of the actuator and it will rotate slowly CCW.
- 12) The speed of the rotation can be increased or decreased by the slow close adjustment valve. Screw in to restrict; out to allow more to flow.
- 13) Cam 1 will transfer after approximately 10 degrees.
- 14) At approximately 45 degrees rotation Cam 3 will make and pick up the close-fast solenoid valve.
- 15) A large amount of oil will now flow at the maximum adjustment rate the accumulator can deliver thru the close-fast valve. This high speed flow can be limited by the close-fast adjustment valve, screw in to restrict; out to allow more flow.
- 16) The actuator will continue to rotate to the full close position.
- 17) At the full closed position, Cam 2 will open and drop out entire circuit. Cam 1 will be made and ready for next open operation.

A note about hydraulic fluid:

The equipment is provided with MIL-5606 hydraulic fluid. The fluid is capable of maintaining specified viscosity over a wide temperature, -40 degree to +170 degree F. See MSDS for specific info. Use of any fluid other than specified will affect the operating characteristics.

When filling and maintaining the HS-2 operator, every effort should be made to insure only DIRT-FREE and WATER-FREE fluid is used. It is important to maintain safe and clean work habits. To do otherwise will jeopardize warranty.

5.0 Add hydraulic fluid to motor/pump reservoir. The filler hole is located on the left side upper flange of the pump housing. Insert the funnel tube (included) into the filler hole and fill with fluid (included) to the TOP of the site glass (located on the left side of reservoir). Note that after the first operation, the excess fluid will fill the actuator and the site glass should indicate fluid level at the red "Fill Line."

NOTE: Do not insert fuses until oil reservoir is filled.

6.0) Insert fuses (included) per following fuse schedule.

| TERMINAL BLOCK POSITION | 24 VOLT | 48 VOLT | 125 VOLT |
|-------------------------------|---|--------------|--------------|
| <i>F1</i> | <i>FRN30</i> | <i>FRN20</i> | <i>FRN15</i> |
| <i>F2</i> | <i>NON6</i> | <i>NON6</i> | <i>NON6</i> |
| <i>F3</i> | <i>NON6</i> | <i>NON6</i> | <i>NON6</i> |
| <i>F4</i> | <i>MDL-5 (Optional-battery charger-24 VDC only)</i> | | |

Decouple operator handle (handle down).

Manually open switch and leave handle disengaged.

NOTE at this time that:

Limit Switch 1 controls a CW rotation.

Limit Switch 2 controls a CCW rotation.

Limit Switch 3 initiates the high speed kick.

Limit Switch 4 operates red/green indicator lights.

See fig. 2 for adjustment detail.

7.0 Depress local/remote selector switch and operate toggle switch to left (open). Recall that the switch is in the open position and that the operator was shipped in half open position or midpoint.

8.0 The output shaft and stop-dog will rotate and stop just prior to coming into contact with one of the adjustable over-travel stops. The unit must stop approximately ½” before the stop-dog comes into contact with the over-travel stop. The over-travel stop should be adjusted to limit the travel of the stop-dog so that the stop-dog is aligned with the manual handle. The limit switch which controls the opening rotation may need adjustment (see 6.0 above to determine the controlling switch).

8.1 Confirm nitrogen pre-charge level is at approximately 825 PSI. When unit completes rotation cycle, observe needle on gauge. As hydraulic pressure bleeds off to zero or when only nitrogen pre-charge pressure remains the needle WILL HESITATE as it descends. This normally occurs at around 825 PSI.

9.0 Manually close the switch.

10.0 Depress local/remote selector switch and operate the toggle to right (close). Observe and confirm that the high speed action is working. Repeat same procedure for over-travel stop adjustment as discussed in step 8.0. The limit switch which controls the closing rotation may need adjustment (see 6.0 above to determine the controlling switch).

11.0 Couple switch to hydraulic operator (handle up and engaged into both switch and power shaft slots). Place a padlock in the locking hole.

12.0 Open the switch with the operator.

12.1 As the switch opens, confirm that the stop-dog and over-travel stops are properly adjusted.
IMPORTANT - Do not overdrive the operator. (See paragraph 14 for adjustment of speed.)

13.0 Close the switch with the operator.

13.1 As the switch closes, confirm that the stop-dog and over-travel stops are properly adjusted.
DO NOT OVERDRIVE.

13.2 Note the two-speed slow/fast close action. The switch blade should move slowly during the first one-half of the closing cycle. At approximately the one-half closed position, the high speed kick should activate.

IMPORTANT—Do not overdrive the operator. (See paragraph 14.0 for adjustment of speed).

14.0 Speed Adjustment:

The power unit manifold (see Fig. 1) contains the cartridge valves for speed/torque adjustment. There are two (2) valves controlling the closing action—one for slow close and one for fast close. There is one cartridge valve for open control. The operator speed is adjusted in the factory to meet most applications. However, in some instances, field adjustment is required.

IMPORTANT:

On closing, it is important to maintain hydraulic pressure thru the slow close action as much as possible. Confirm that it is holding steady with the pressure gauge. If it is not, restrict the slow close fluid flow. Adjustment of speed is accomplished by rotation of the allen-keyed stem of the cartridge valve. Note that the stem is secured by a hex nut locking collar. Always lock down the stem after adjustment. Clockwise stem rotation decreases speed. Counter-clockwise stem rotation increases speed. Adjust the cartridge valves to achieve the desired operating speed in the open and close directions.

Timing/High Speed Kick: Limit switch 3 (see Fig. 1) activates the high speed kick function in the close cycle. Generally, this should occur at the one-half closed position. Change the position of Cam 3 to alter the initiation of the high speed kick.

15.0 After all adjustments are completed, pierce all set screws and tighten both cam set screws.
Tighten lock down stops and remove shipping caulk from around rain seal on top of cabinet.

16.0 Pressure switch:

DO NOT ATTEMPT TO CHANGE THE PRESSURE SWITCH SETTING.

The pressure switch is factory set. In most cases a setting change will have little or no effect on the majority of applications. Higher pressures may be required to properly operate some high torque switches. Contact the factory prior to making any pressure switch adjustments.

17.0 Battery Charger Adjustment:

To fine tune a factory provided battery charger (optional): a) remove F4 fuse on swing panel cover ;b) adjust voltage output to 24.0 - 26.5 VDC; c) replace F4 fuse.

NOTE: Battery must require charging to cause current to flow.

As battery approaches full charge, the current will drop off.

18.0 Connect remote control wiring: (see wiring diagram)

Three wires from customers equipment are required:

Common - + found on TB - 5

Open - found on TB - 6

Close - found on TB - 7

Note that customers control input must be disengaged prior to end of HS-2 operation. If it is not, unit will continue to attempt to operate. The HS-2 electrically seals in requiring only a short duration (< 1 sec.) control input.

19.0 Rotation Limits

All HS-2 units are factory adjusted for 90 degree rotation, unless specified otherwise. If the application requires greater than 90 degree rotation, make the following changes:

- a) Change the position of the over-travel and lockdown stops located on the power shaft just outside and above the HS-2 cabinet to the desired position.
- b) Change the position of cams for LS1, LS2, LS3 and LS4 to reflect the increased travel. See Section 6.0 of instruction book to determine which cam controls the particular function of the operator.

20.0 Reversing the Unit

All HS-2 units are factory wired for CCW closing unless specified otherwise. If it is necessary to reverse the unit for CW closing, make the following connection changes:

- a) Reverse the flexible hoses on the actuator.
- b) Interchange green and red wires on LS1 and LS2.

- c) Interchange blue and orange wires on LS1 and LS2.
- d) Interchange green and red wires of LS4.
- e) Move yellow wire from LS3 -- normally open to LS3 normally closed.
- f) Mark up appropriate wiring diagrams to reflect actual installation.

21.0 Consult attached trouble shooting guide in the event of installation problems.

HS-2 TROUBLESHOOTING

PROBLEM: Everything dead—no red or green indicator lamp.

- 1) Replace fuse 2

PROBLEM: Have indicator lights but motor relay only clicks.

- 1) Battery voltage possibly low
- 2) Replace fuse 1

PROBLEM: Pump motor running but slight or no pressure build up.

- 1) Low on oil - fill to top of site glass
- 2) Defective pump - replace
- 3) Defective accumulator - replace

PROBLEM: Pressure builds to 1200 psi or above, but actuator does not rotate.

- 1) Low batteries - voltage below pickup of start relay
- 2) Defective start relay - replace
- 3) Defective pressure switch - replace
- 4) Respective open/close valve:
 - a) May be sticking
 - b) Coil may not be closing
 - c) Check resistors on 125 VDC units

- 5) Speed adjustment valves closed - open and adjust

PROBLEM: Operator starts to open or close then stops—oil pressure keeps on building.

- 1) Check limit switches - defective or need adjustment
- 2) Defective open or close relays - replace
- 3) Open and close relay closing at same time - check wiring

PROBLEM: Operator opens or closes without pressure build up.

- 1) Accumulator over charged - not to exceed 825 psi
- 2) Pressure switch defective or misadjusted - replace - readjust
- 3) Respective open/close valves stick - open - remove and check - replace if defective.

PROBLEM: Operator not shutting off at end of cycle.

- 1) LS1 or LS2 defective or out of adjustment
- 2) Respective relay holding on - replace

PROBLEM: No fast close.

- 1) Defective or out of adjustment LS3

- 2) No accumulator charge—pressure gauge should read 825 psi immediately after pump starts then build to 1200 psi. Read on shut down.
- 3) Fast close valve:
 - a) May be sticking
 - b) Coil may not be closing
 - c) Respective resistors on 125 VDC unit may be open
- 4) Slow close adjustment valve open too far, using too much fluid - restrict
- 5) Fast close adjustment valve not open enough
- 6) Accumulator overcharged - not to exceed 825 psi (should have minimum pressure differential of 375 psi between pre-charge and pressure switch setting)
- 7) Unit low on oil

PROBLEM: Pressure gauge will build to 1200 psi then drop to “0” then back to pre-charge and above.

- 1) Not enough pressure differential between pre-charge and pressure switch setting - re-set pressure switch, replace accumulator.
- 2) Excessive oil in accumulator, giving false reading to pressure switch - remove accumulator and drain excessive oil before adding nitrogen. Normally we to low precharge. Replace accumulator.
- 3) Slow-close or open adjustment valve open too wide.

PROBLEM: Actuator has jerky start - stop reaction.

- 1) Start relay is defective - replace
- 2) Pressure switch defective - replace
- 3) Manual handle assembly riding on top drip shield plate. Raise assembly off drip shield one (1”) inch.

PROBLEM: Pressure builds slowly, pressure gauge does not jump to 825 psi on start.

- 1) Accumulator has no gas pressure - replace Note: When charging accumulator, always remove remaining gas/oil before re-charging. Consult factory for pre-charge kit.

RECOMMENDED SPARE PARTS

| <i>DESCRIPTION</i> | <i>FOR 1-3</i> | <i>FOR 4-10</i> |
|---------------------------------|----------------|-----------------|
| | <i>UNITS</i> | <i>UNITS</i> |
| Open/Fast close cartridge valve | 2 | 4 |
| Open/Slow close solenoid valve | 1 | 2 |
| Slow close cartridge valve | 1 | 2 |
| Solenoid | 2 | 3 |
| Fast close solenoid valve | 1 | 2 |
| Time delay relay | 1 | 2 |
| Motor relay | 0 | 2 |
| Start relay | 1 | 2 |
| Open relay | 1 | 2 |
| Close relay | 1 | 2 |

| | | |
|------------------------|---|---|
| 100 Watt heater strip | 1 | 3 |
| Accumulator | 0 | 1 |
| Limit switch | 1 | 3 |
| Pressure switch | 0 | 1 |
| Power Units (complete) | 0 | 1 |