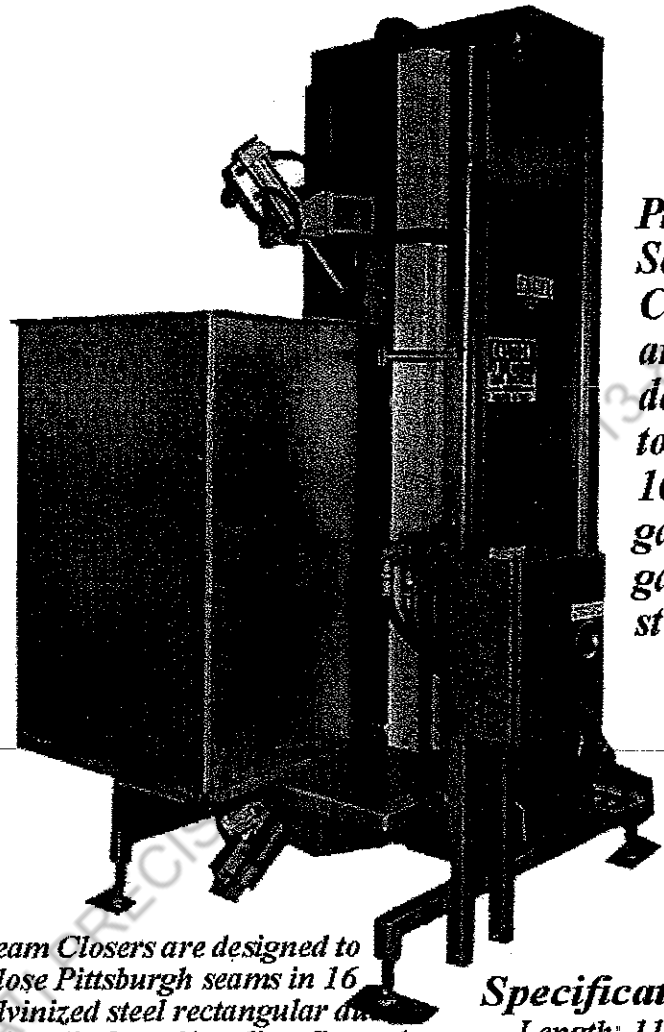
Engel Pittsburgh Seam Closer

M-516/616-PS



Pittsburgh Seam Closers are designed to close 16 - 26 gauge galvanized steel.

Features

Engel's Pittsburgh Seam Closers are designed to quickly and quietly close Pittsburgh seams in 16 through 26 gauge galvinized steel rectangular duct. The seam closer can handle from 2' to 6' unflanged ductwork, and 4', 5' and 6' flanged sections of both lined and unlined duct. Typical clamp-seam-unclamp cycle time for a 5' seam is 20 seconds. The pass-through design simplifies and speeds product flow. Units are equipped with optional wheels (MR-MAK-800) for ease of movement in your plant or on job site. Quiet operation reduces fatigue and minimizes potential injuries. Quiet operation also allows work to proceed where noise limitations may apply. Self contained hydraulic power unit powers all functions, no air required. Powered, hardened steel closing wheel is hard chrome plated for long operation and ease of maintenance. Vertical pittsburgh seam closer also available.

Specifications M-516-PS

Length: 117 in.
Width: 36in.
Loading height: 31 in.
Gauge range: 16 to 26 gauge
Shipping weight: 1,400 lbs.
Vicker Hydraulic Power Unit
5HP 230/460V/3/60 Elect. Motor
Pressure compensated piston pump
10 Gallon Reservoir

Specifications M-616-PS

Length: 129 in.
Width: 36 in.
Loading height: 31 in.
Gauge range: 16 to 26 gauge
Shipping weight: 1,600 ibs.
Vicker Hydraulic Power Unit
5HP 230/460V/3/60 Elect. Motor
Pressure compensated piston pump
10 Gallon Reservoir

**Note: Other Horse powers available on electric motor. The 3HP 220V/1/60 is not available on this unit. A 3HP 230/460V/3/60 is.*

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Roll Forming Machine
Engel Pittsburgh Seam Closer M-516/616 PS
Index

Hand Operated Instructions
Hydraulic Powered
Pittsburgh Seam Closer

1. Turn power ON and push Hydraulic Valve Handle toward machine to raise clamps to full "up" position.

CAUTION: When connecting electrical source, be sure to use local electrical code requirements

NOTE: Check the motor to see if there is a Rotation Arrow If not, the rotation can be either way

2. Position Clamp Assembly so that approximately 1"– 2" clearance will be at each end of he duct.

3. Position duct in machine so that it is against the Chromes Seamer Roll on the operator's end and even on the opposite end The clamps will position the duct by moving it side ways about 1/8" as the clamps come into the full "down" position.

4. Pull Outward on the Hydraulic Valve Handle until the clamps are full "down"

5 Set the hands Knobs (2) that are on the operators side of the machine for light or heavy gauge metal.

Minimum Capacity is 26 Gauge. Maximum Capacity is 16 Gauge galvanized iron To run 16 Gauge, turn the hand knobs "clockwise" until they stop

To run lighter Gauges, simply turn the knobs "counterclockwise" All the way in is factory set for 26 Gauge and all the way out is set for 16 Gauge.

6. Push the large green "start" button on the control panel for about one second The machine will automatically run across the seam and back to the "start" position and remain there until the button is pressed again

Remove or rotate the duct for additional seaming as necessary.

Automatic Clamping Operating Instructions
Hydraulic Powered
Pittsburgh Seam Closer

1. Turn power on and with the selector switch in the hand-powered position, and then push the green stat button.

   CAUTION: When connecting electrical source, be sure to use local electrical code requirements

   NOTE: First check the motor to see if there is a Rotation Arrow. If not, the rotation can be either way.

2. Position clamp assembly so that approximately 1"-2" clearance will be at the end of the duct.

3. Position duct in machine so that it is against the Chromed Seamer Roll on the operator's end and even on the opposite end. The clamps will position the duct by moving it side ways about 1/8" as the clamps come into the full "down" position.

4. Turn the selector switch to the first pass position. With the selector switch in place press the blue reset button.

5. Turn the selector position to automatic.

6. Push the amber cycle start button.

   CAUTION: The machine will automatically clamp and remain under high pressure momentarily. The machine will then begin seaming the material from the bottom to the top most position. Once the forming roll reaches the top, it will engage a micro switch that will do two (2) things.

   A. It will unclamp the clamps for immediate duct removal

   B. It will return the seaming roll to the home position

   NOTE: For two (2) pass operation, do #4 above with switch in the second pass position, and the clamps will remain engaged until the roller reaches the home position, at which time the clamps will then release for duct removal.

7. Remove or rotate the duct for additional seaming as necessary

Adjustment Instructions
Hydraulic Powered
Pittsburgh Seam Closer

1. Positioning of Clamps

Sideways: Set with Gib Adjustment Screws. The clamp pads at both ends need to be approximately 1/32" out over the base toward the chromed seamer wheel

Endways: Set for duct length by loosening the rear hand knobs on the end away from the "start" position.

2. Seaming Wheel Height

Sets with the 45-degree edge above 7/16" above the base and is tilted toward the base with a .030" shim under the rear of the bearing block. If the wheel is too high or the seam edge is too long, the 26 Gauge will wrinkle If the wheel is too low, the 16 Gauge will not close adequately

3. Hand Knobs for Light and Heavy Gauge

These are equipped with double jam nuts for the 16 Gauge position and jam nut stop screws for the 26 Gauge position, both can be reset by unlocking the jam nuts and re-locking them after making the required adjustment

NOTE: Due to difference in metal thickness, seam edge length variations, etc , it may be necessary to make adjustments. It may be desirable to make partial turns when changing from 16, 18, 20, 22, 24 and 26 Gauge thick duct.

4. Hydraulics

The manual for the Hydraula-Pak is included The only adjustment is the Flow Lever If it is set too slow, the machine will stall. Inversely, the machine will run faster as the lever is moved to full flow

5 Micro Switches

Located on lower rear of clamp assemblies. These are tripped at each end of the cycle The trips are slotted bars that can be moved in the direction of travel They are positioned so that the wheel stops without hitting the TDF flange if required.

6. Timer

Located in control panel This is time for the hydraulic valve to shift to a neutral position so that it can be reversed One (1) second is recommended time setting

NOTE: Residual oil from testing may leak during transit and should be of no concern. To avoid damage in transit, electric motor is removed after testing of unit and packed separately.

To assemble electric motor to the pump cartridge assembly, stand the electric motor shaft up, on a bench and place the shaft coupling with key in place, over the shaft. Push on all the way and tighten set screw.

Remove the pump cartridge and cover from the oil reservoir and remove the four nuts holding cartridge to cover. Discard nuts (On 7-1/2 HP and larger units bolt electric motor casting to electric motor with bolts provided.) Place pump cartridge including cover over upright electric motor shaft and rotate back and forth until splines engage each other. Note – grease on pump spline should not be removed. Locate electric motor connection box in best of four positions for your application and tighten bolts directly into motor casting.

Make sure all connections and screws are tight and return electric motor/pump cartridge to reservoir.

Lubrication

Electric Motor – Bearings are factory greased and sealed and require no additional lubrication.

Hydraulic Pump – Replenish oil in reservoir to keep Sight Gauge approximately ¾ full.

Change oil quarterly for normal applications, more often for difficult or exceptional conditions. (See "Service" for additional information.)

Hydraulic Motor – Hydraulic motor is self lubricating from internal leakage requiring an external Drain line to carry excess oil back to reservoir.

Installation

In applying a variable speed drive to a given application it is well to keep in mind that its primary purpose is not to act as a speed reducer, but rather to provide "variable speed". Indeed, in many instances a speed reducer or reduction through gears or pulleys is employed in conjunction with the variable speed drive.

The reason for this is twofold. First, efficiency is greater at or near full RPM and second, initial cost can be considerably reduced by use of a far smaller drive than would otherwise be required. For instance, a given low speed application may require a 50 HP variable speed drive when used without reduction equipment between the drive and driven machine whereas with suitable reduction equipment the same application may be handled by a 10 HP unit.

The hypothetical examples which follow point this out very well, (see nameplate for actual torque and speed rating). The variable speed drive has fixed maximum "torque". If the required speed is low, compared to the maximum RPM of the variable speed drive, horsepower will be "wasted" if the drive is set to operate at the low RPM. If, however, reduction is accomplished by mechanical means, the torque output is proportionately multiplied thereby permitting a smaller drive to do the larger jobs. This horsepower then is utilized.

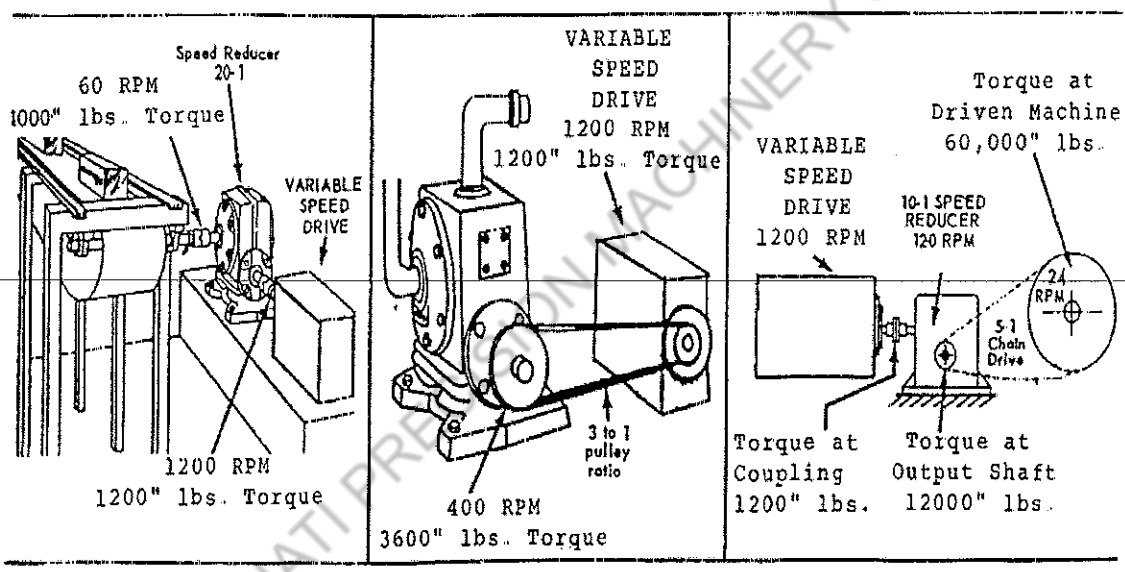


FIGURE 1A FIGURE 1B FIGURE 1C

The torque requirement of your driven machine is easily determined by use of an inexpensive torque wrench or a pipe wrench and scale. Protect the shaft with a cloth and then clamp the wrench to it. In the case of the torque wrench, the torque will be read direct in inch pounds. With a pipe wrench, multiply the scale reading by the distance, in inches, from the shaft center to the point where the scale touches the wrench handle. As a hypothetical example – with 100 lbs. scale reading and a lever length of 36" the 1200 in lbs. a 3 to 1 ratio (or greater) would be suitable Always push or pull at right angles to the wrench since the torque required to start our shaft will be the greatest—use this figure in computation.

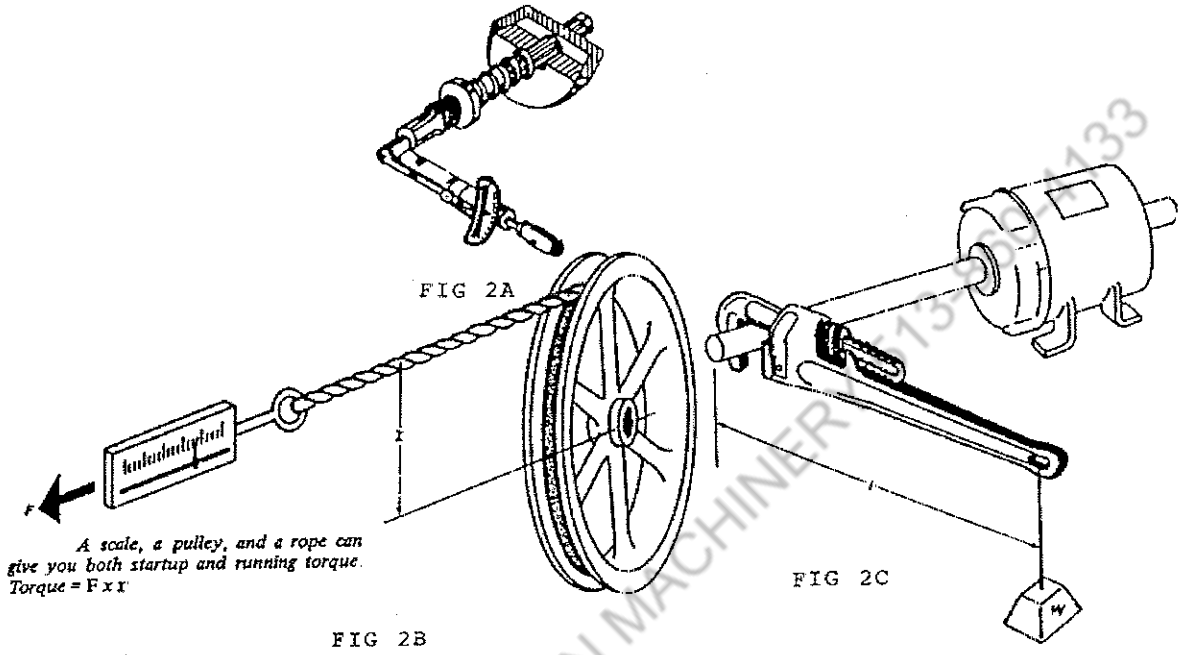


FIG 2A

A scale, a pulley, and a rope can give you both startup and running torque. Torque = F x r

FIG 2B

FIG 2C

Reduction may be accomplished by any means: pulleys, gears, sprockets, speed reducers, etc. Pulleys should be used for deductions of relatively low ratio (2:1, 4:1 etc.) for high ratio reductions, gears or speed reducers are best. It is obvious that a 100 to 1 reduction would be quite difficult with pulleys whereas a speed reducer would perform well under such conditions

Ideal conditions are to set up the drive with a speed reducer, pulleys or gears of such ratio that with the transmission operating at top speed the driven machine will turn about 25% over its desired RPM. The transmission can then be used to reduce the speed to the exact requirement and provide a variable speed drive with maximum RPM of 1200 and speed requirement of the driven machine to be a range of 50 to 350 RPM. In this example then, a 3:1 ratio between the transmission and driven machine (ex. 2 ½" pulley on transmission shaft and 7 ½" pulley on driven machine) will give a speed range of 0 to 400 RPM which will satisfy the requirements. In this case the usable horsepower is increased three times whereas without the pulley ratio this horsepower would be wasted

Proper application then is most important as well as most economical.

Operation

For the purpose of this instruction booklet the electric motor, pump, and reservoir will be referred to as the power unit or the "A" end, and the hydraulic motor will be considered the "B" end.

Remove the protective covers and caps from the hydraulic hose, the drain hose, the hydraulic motor, and power unit Make certain no dirt or foreign material enters any of the openings. Place a small amount of pipe sealer on all external threads in such a manner as to prevent any of the sealers from entering into the hose, hydraulic motor, or power unit. (Under no circumstances place the sealer on the internal threads). Connect hoses between the "A" ad "B" ends Interchanging the high pressure and return line at "B" end will reverse direction of the hydraulic motor Instantaneous or continuous reversing can also be accomplished by use an instantaneous reversing valve available as a separate item (manual operated stock #CVM753, solenoid operated #SV115-0) Tighten all fitting connections to prevent leakage

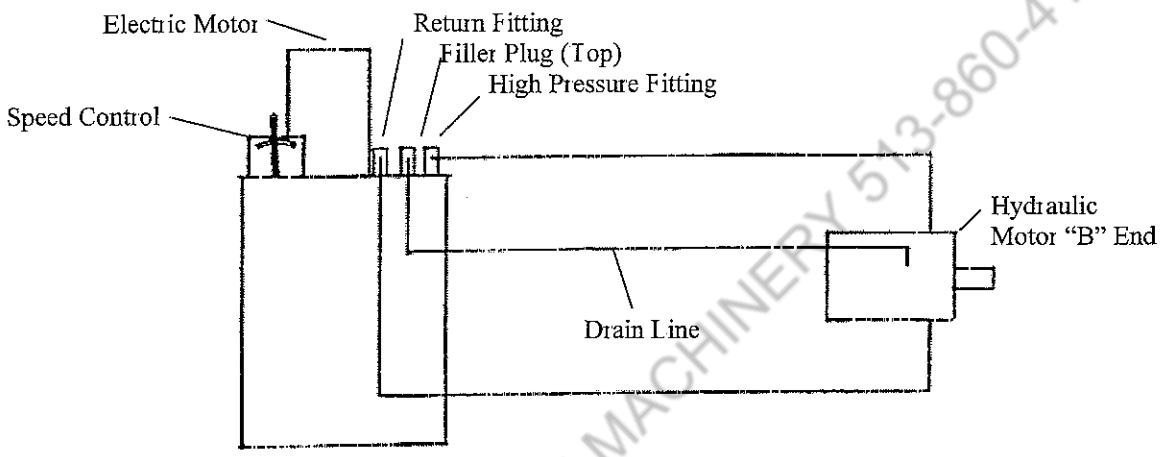


Figure 3

The power unit can be located in any convenient place either at the driven machine or at a remote location as long as free circulation of air around the unit is possible. If the hydraulic hose supplied with the unit is of insufficient length, longer lengths may be added as required. Pipe or tubing may also be used if desired. Regardless of the material used it must be capable of a 3000 pound working pressure and of course impervious to oil. The drain line carries no pressure and can be any oil resistant hose. Hydraulic hoses are available from our catalog.

The hydraulic motor should be located at the driven machine and can be mounted in any position. If mounted in any position other than with the drain connection at the top, a loop must be made in the drain line to extend above the top of the hydraulic motor. This will insure that the hydraulic motor is always full of oil, upon which it depends for lubrication. Restricting or plugging the drain line will cause leakage at the output shaft seal and other mating surfaces of the hydraulic motor.

Before starting the unit, remove the filler plug from the reservoir and fill with any good grade industrial, mom-foaming, hydraulic oil with a viscosity of approximately 150 to 240 SUS at 100 degrees Fahrenheit – 20WI approximately Do not use motor oil Because of shipping cost this oil is best obtained locally. Oil should fill the reservoir to keep the Sight Gauge about ¾ full and should be maintained near this level In any rotating machine, oil is "lost" at the seals and connections, and must be replaced periodically. Entrapped air in the unit may give a false indication of oil level. To insure proper oil level, operate the unit a short time and check the oil level again, if necessary add additional oil and repeat until the sight Gauge is about ¾ full Required amount of oil will depend to some extent on the length of hydraulic lines.

Electrical connections can be made by removing the electrical connection cover that exposes the motor leads. Motor rating is as shown on plate affixed to machine and can rotate in either direction. Electrical

connections to the motor should be made through a magnetic starter with overload protection for the motor and should be flexible for ease of maintenance and cleaning. Magnetic starter, flexible cord and plug can be mounted directly to connection box or electric motor feet (if provided) making unit entirely portable and facilitating cleaning and servicing

When the unit is first operated it will be quite noisy due to air entrapped in the system. Running the system awhile will expel this air. While operating, especially under heavy load, the unit will "whine". This is normal, due to the internal high oil pressures and should cause no alarm. Operating temperatures rise high enough to be very hot to the touch but should always remain within safe limits.

Output shaft will not go to zero (0) RPM without at least a nominal load attached (little more than hand pressure is required). This pre-loads the system. The external speed control mechanism consists of the quadrant plate with two movable stops, the quadrant handles with tension spring assembly, and quadrant shaft assembly. The stops can be set at any position to give desired speeds. A provision is made to adjust the internal mechanism to correspond to a right hand neutral off position of the quadrant handle. To adjust, position the quadrant handle at the extreme right position with both stops and operate the unit under power. With a screwdriver, hold the slotted end of the quadrant shaft in position and loosen the locking nut. Turn the screwdriver slightly to the right or left as required until the transmission output shaft comes to a stop and retighten locking nut. **CAUTION**: When turning the slotted shaft, do not force past its limits. The adjustment must be made while unit is connected to load. Output shaft will not go to zero unless it has a small load to pre-load the hydraulic system.

If desired, automated control of the quadrant handle can be accomplished with solenoids and trip or limit switches. This is particularly appropriate for operation of approach, cut and transverse operation of machine tool beds, slides, etc. The simplest procedure is to link the solenoids to the quadrant handle with springs and set the stops for handle position. This provides accurate positioning but eliminates the need for accurate linkage between solenoid and quadrant handle. Automated instantaneous or continuous reversing can be accomplished in the same manner when used with a solenoid operated instantaneous reversing valve, available as a separate item (stock #SV115-0)

For "take up roll" applications requiring a fixed "feet per minute" control rather than a set RPM, a follower arm linked to the quadrant handle can ride the take up roll for continuous speed adjustment and "fixed feet per minute" operation.

Service

1. Replenishing Oil

Replenish oil in the reservoir to keep the Sight Gauge about ¾ full. Cleanliness is of the utmost importance in handling the oil

2. Changing Oil

Change oil quarterly for normal applications, more often for difficult or exceptional conditions.

A. Operate the unit for 5 to 10 minutes to bring its temperature up before draining. Remove locking band from cover and withdraw entire motor pump cartridge, set aside to drain in a clean place Empty and clean tank. Note condition of oil.

B. Wash the filter free of dirt, lint and other foreign particles. Use solvent and allow to dry.

C Examine the oil. If there is evidence of excessive sediment or sludge in the unit, refill with clean oil, operate a few minutes, then drain again. Re-clean the filter.

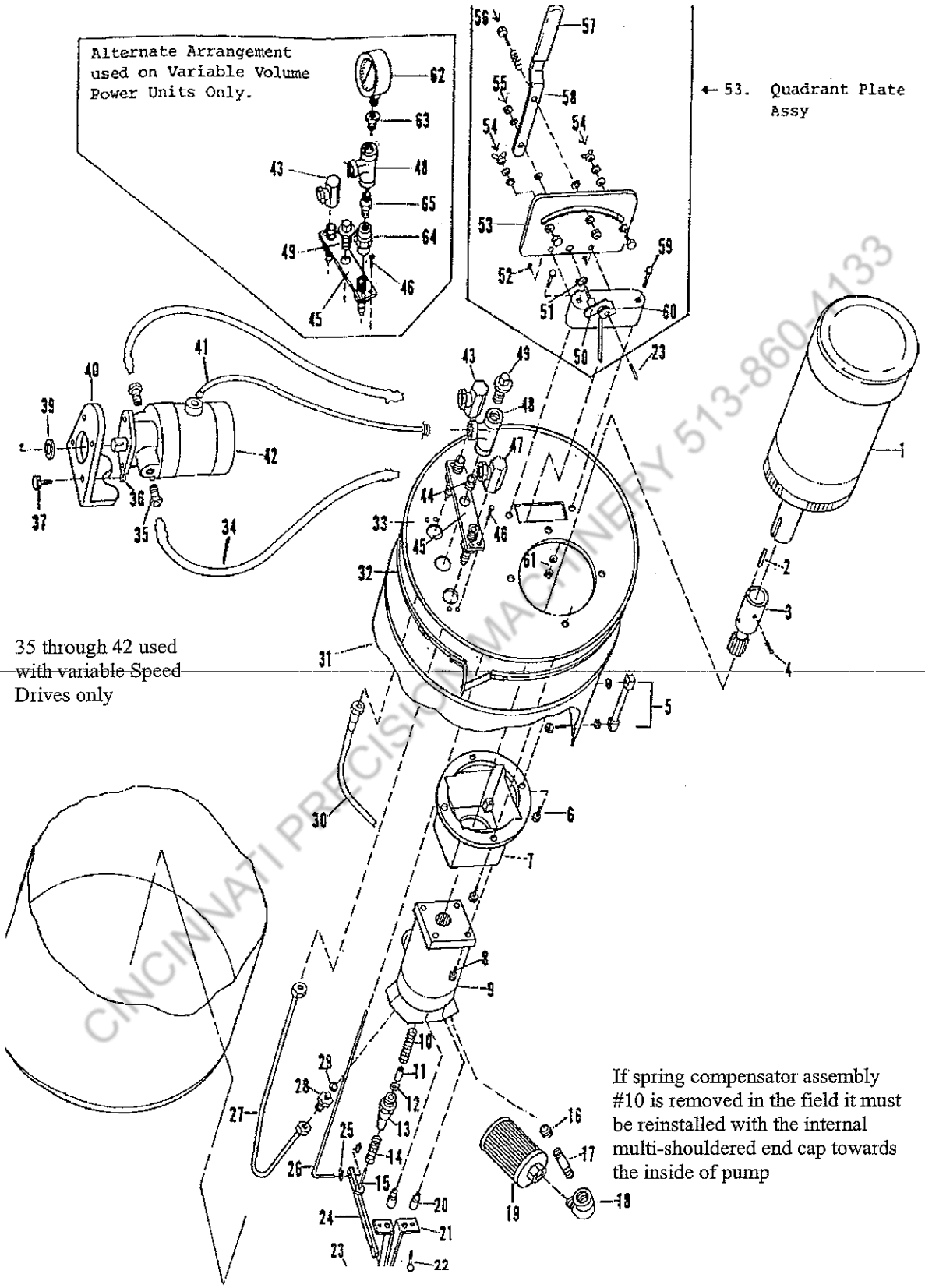
NOTE: Do not flush with any liquid as this would dilute the oil.

D. Fill the reservoir so Sight Gauge will be about 3/4 full when reassembled – either directly into the tank or replace motor pump cartridge and refill through filler plug opening. Entrapped air in the system may give a false indication of the oil level. To insure proper oil level and distribution of the new oil to all parts of the unit, operate for five minutes, stop the unit and after waiting a few minutes to give the oil a chance to seek its true level, check the level again. If necessary, add additional oil

3 Pulley-Belts

Pulleys should be regularly checked to see if they are hot to the touch. Overheated pulleys can usually be traced to excessive belt slippage This heating is readily transmitted to the bearings and often causes bearing failure. If the load is so great that belt slippage can only be prevented by over-tightening the belts, another method of connection (ex. Gears) should be used.

Figure 4QC Exploded View



Key to Figure 4 Q C

1	Electric Motor – specify nameplate data
1a.	Electric Motor Casting
1b	Electric Motor Casting Bolts
1c	Electric Motor Casting Lock washers
2	Key
3	Coupling w/shear section
4.	Set Screw
5.	Oil Level Gauge Assembly
6.	Electric Motor Mounting Bolts
7	Adapter Casting
8.	Pump Mounting Bolts
9-15.	Hydraulic Pump Assembly (including spring compensator assembly, spacer retainer ring, cap, spring, plunger.)
16.	Inlet Reducer
17.	Inlet Pipe
18	Inlet Elbow
19	Suction Filter
20	Spacer
21.	Bracket
22.	Bracket Mounting Screws
23	Roll Pin
24	Control Bar
25	Retaining Ring
26.	Control Rod
27.	Pressure Line
28	Discharge Fitting
29.	"O" Ring
30.	Return line
31.	Reservoir
32.	Locking Band
33.	Reservoir Cover
34.	Hydraulic Hose (3000PSI)
35	Reducer Fitting
36.	Hydraulic Motor
37.	Hydraulic Motor Mounting Bolt
38.	Key
39.	Hydraulic Motor Output Shaft Seal
40	Mounting Base
41.	Drain Line Hose
42.	Hydraulic Motor Assembly (replacement hydraulic motor includes parts 35 through 40 and 42. Parts 35 through 40 and 42 are also available as separate items)
43.	Return Fitting
44	Nipple
45.	Connection Plate Assembly
46.	Connection Plate Screws
47.	Pressure Fitting
48.	Tee
49	Filler Plug
50	Quadrant Shaft Assembly
51	Spring Washer
52.	Quadrant Plate Mounting Screw
53.	Quadrant Plate
53a.	Quadrant Plate Assembly
54	Wing-nut Stop Assembly (wing-nut washers, nut)
55.	Nut and Washer Assembly
56.	Tension Assembly (screw, spring, washers, nut)
57	Plastic Grip
58.	Quadrant Handle
59.	Cover Box Mounting Screw
60.	Cover Box
61.	Cover Box Nut and Washer Assembly
62	Gauge
63	Reducer
64.	Coupling
65.	Nipple

All parts may be ordered by giving complete information consisting of key number, figure number, description, and stock number of unit (as shown on nameplate) which part is to be used on Example:

1-#19, Fig 4 Q C, suction filter for HVX3650

Anything less than this complete information can only cause delay or error.

Troubleshooting

1. General

Causes for malfunction within the system can be narrowed down to installation, electrical, linkage, and hydraulic troubles. Failure of the unit to turn is not necessarily an indication of trouble in the hydraulic components Since the hydraulic components are controlled by mechanical linkage and are dependent on the electric motor and associated items, a fault in these sections will affect hydraulic operations as well Hydraulic troubles are very rare.

NOTE: IT IS IMPORTANT TO NOTE THAT FOR 26 GAUGE CAPACITY THE EDGE OF THE PITTSBURGH THAT IS TO BE BENT OVER IN THE SEAM SHOULD NOT EXTEND MORE THAN ¼". ANYTHING BEYOND ¼" IS LIKELY TO RESULT IN A WRINKLE AND WOULD NORMALLY BE CONSIDERED UNEXCEPTABLE.

THE PITTSBURGH LOCK SEAM MUST BE STRAIGHT "THE HARD WAY" ALONG THE EDGE OF THE LOCK THAT THE MALE FLANGE RESTS APON WHEN BEING SEAMED (BOWING UP OR BOWING DOWN IS NOT WHAT IS BEING DISCUSSED HERE, BUT IN FACT BOWING SIDE-WAYS, THIS IS USUALLY 1/16" OR LESS BUT WILL CAUSE WRINKLES). AN OUT-OF-STRAIGHT-CONDITION IS USUALLY THE RESULT OF THE IN-FEED GUIDE BEING IMPROPERLY ALIGNED TO THE PITTSBURGH ROLLS. THE DEGREE OF SIDE CAMBER, OR OUT OF STRAIGHT CONDITION, ON THE PITTSBURGH SEAM IS DIRECTLY ATTRIBUTABLE TO WRINKLE THAT IS GENERATED IN THE SEAMING PROCESS.

EXTREMELY SMALL LIGHT GAUGE SEAMING OPERATIONS USUALLY RESULT IN THE CENTER OF THE DUCT SECTION NOT BEING AS TIGHT AS THE ENDS. THIS IS A DIRECT RESULT OF THE SMALL DUCT SECTION BENDING AWAY FROM THE SEAMING OPERATION IN THE CENTER.

2 Installation

If a unit fails to do a job the first time it is installed, the difficulty is probably in the installation. It would be unrealistic to immediately think the trouble was in the transmission. Review section on installation. Is the proper reduction ratio used between the transmission and the driven machine? Is the torque requirement too great for the hydraulic system without reducing further? Are all lines tight? Reservoir full? If failure occurs after the unit has been performing a job satisfactorily for some time first determine if any changes have been made on the job No matter how slight and insignificant they may appear these are the logical sources of trouble

3. Electrical

Because electrical difficulties are usually so simple they are often completely overlooked. Yet they are by far the most common Some of these are:

A. Open switches or blown fuses
B. Overloads tripped
C. Starter defective
D Motor single phasing
E Loose wiring connections

Of these, probably only single phasing needs further explanation. This is a condition where a 3 phase line has one fuse blown or breaker open, creating in effect, a single phase current. If a motor is connected to such a line it will hum and draw a very high current but will not ordinarily start. The complicating factor is that if two or more motors are supplied from the same line and the fuse blows while one of them is operating; testing elsewhere on the line may indicate no

problem since 3 phase current will be fed back to the line from the operating motor. This motor will continue to operate, unless its load is sever, but will draw a current overload. If another motor is then started from the line it may even start due to the feedback but it too will be drawing a current overload.

If the power drive motor fails o start make certain a single-phase condition does not exist.

4. Linkage

Malfunctions due to speed control linkage can easily be determined by visual inspection. Usually these can be corrected with minor adjustments. Some possibilities are:

A Handle loose on quadrant shaft or not properly "zeroed"
B Control rod disconnected
C. Linkage bent or broken
D Pump plunger stuck in cap

5 Hydraulic

Hydraulic troubles are not too common Indeed they will seldom occur if the oil is kept clean, kept to proper level and changed regularly. Painstaking care must be taken to avoid entry of dirt or foreign matter into the unit – especially when changing oil Any malfunctions due to hydraulic difficulties will show up as a loss in output torque (pressure) or a loss in maximum speed (gpm). Make sure, however, that the problem is in the hydraulics and not in the adjustment of linkage (see "linkage"). Cause of these hydraulic difficulties could be:

A. Low oil level
B. Ruptured oil line
C. External valves or other devices operating improperly
D Pressure compensator assembly (pressure limiter) operating improperly (see exploded view)
E. Faulty Pump
F. Faulty Hydraulic Motor

In order to receive maximum torque (pressure) from the transmission make sure that any relief valves, found in reversing valves etc., added to the system are not set lower than the maximum PSI capabilities of the hydraulic pump.

Output shaft will not go to zero (0) RPM without at least a nominal load attached to preload the system.

6 Testing

A test can be made to check the overall conditions of the system and pinpoint any difficulties. **Before testing, remove all external valving if any, and work only with "A" end, "B" end and hoses**.

Torque test the system directly on the hydraulic motor output shaft as described in "Installation: and compare with rating. If torque reading is considerably lower than rating, pressure test the "A" end alone by removing the hydraulic pressure hose from the right fitting on the "A" end and replacing it with a 0-5000 PSI Gauge. Start the "A" end electric motor with the quadrant lever at 0 RPM position, and slowly move the lever until maximum pressure is registered on the gauge (move handle no further than necessary to obtain maximum reading and return to 0 RPM position) If maximum pressure reading is approximately same as nameplate reading, "A" end is satisfactory and problem is in "B" end. If pressure reading is considerably lower, trouble is in "A" end in which case check components in this order:

A. Coupling between electric motor and pump
B. Electric motor
C. Linkage
D. Internal pressure line and fittings
E. Pump

Cleanliness is of the utmost importance in a hydraulic system Normal operation can contaminate the oil with small metal particles These contaminants can cause unnecessary excessive wear in the hydraulic system Therefore, change oil quarterly as described in "Service" for maximum life of hydraulic system. When replacing a worn component in the system, always change the oil and flush the system as described in section C of "Service". This procedure will ensure maximum efficiency and life from the hydraulic system.

Malfunction	Probable Cause	Corrective Action
1. Electric motor will not start	-Blown fuse	-Replace
	-Overload tripped	-Reset
	-Motor is single phasing	-Check fuses and relays
	-Starter defective	-Replace
	-Loose wiring connections	-Check wiring
	-Defective electric motor	-Replace
2. Transmission unable to drive load	-Load is too heavy	-Increase operating speed of of transmission so as to run close to top speed and reduce speed of driven machine back to normal by use of gears, pulleys, etc. Full efficiency is achieved with transmission operating at or near its top speed (see "Installation" section).
		If transmission is already operating at top speed, driven lad is too great for unit. Reduce speed of driven machine by gear ratio until transmission can handle the job
	-Load is binding	Correct
3. Low output speed	-Pressure fittings loose	-Tighten fittings
	-Oil level too low	-Fill with oil so Sight Gauge is ¾ full.
	-Oil-filter clogged	-Remove filter and clean
	-Linkage out of adjustment	-Readjust linkage (see p 9)
	-Worn pump	-Replace
	-Worn hydraulic motor	-Replace
4 No output speed	-Sheared coupling or key	-Replace
	-Linkage bent, broken or disconnected	-Replace
	-Ruptured oil line	-Replace
	-Worn or defective pump	-Replace
	-Worn or defective hydraulic motor	-Replace

In order to receive maximum torque (pressure) from the transmission, **make sure that any relief valves found in reversing valves etc., added to the system, are not set lower than the maximum PSI capabilities of the hydraulic pump.**