DRY ICE PRODUCTION

迪普干冰制造（大连）有限公司

Must Read Before Use

Operating Manual

JET-500

Dry Ice Pelletizer

Http: www.dip-dl.com
Email: dip@dip-dl.com

expert enable Growth 成长源于专业

CAUTION

- READ THE MANUAL BEFORE THE FIRST TIME USE
- Store the manual for later use or subsequent operator
- We are pleased to provide the electronic manual if it is losted

安全说明 / Safty Instruction

Summary Info of Dry Ice Safty Data Sheet

Chemical Name	Solid Carbon Dioxide
Other Names	Carbon Dioxide、Dry ice
CAS#	CAS NO.124-38-9
Percentage	100%
Health Hazard Acute and Chronic	Concentration in excess of 1.5% carbon dioxide may cause death. At higher concentrations, displaces oxygen in air below levels necessary to support life.
Warning Sign	
Grade	Warning
Warning Word	WARNING! Frozen carbon dioxide – extremely cold solid. Vapor can cause rapid suffocation.
Protection Wears	Groves、Goggle
Storage	By dry ice containers that place in a protected area with good ventilaton
Shipment	Packages should be transported in a secure position in a well ventilated vehicle.
Emergency & First Aid Procedures:	Inhalation: Remove to fresh air. Assisted respirant and supplemental oxygen should be given if not breathing. Frozen tissues should be flooded/soaked with tepid water. Do not use hot water. Obtain medical attention in all cases.
Steps if Material Released/Spill	Ventilate indoor areas well to avoid hazardous CO2 concentrations. Ventilate area well and avoid contact with cold vapors/dry ice. CO2 is heavy gas and will remain in low spots without assisted ventilation.
Fire Measures	Carbon dioxide cannot catch fire
Materials to Avoid	Carbonic acid/salt/corrosive chemicals
References	MSDS、RTECS、HSDB、ChemWatch

*Detailed MSDS can be obtained by contact us

Section1. Introduction

The DIP Pelletizer Model Jet-500 is design to produce dry ice pellets for filling pellet storage and delivery totes,or RDS hoppers directly. It contains CO_2 pellet making system and all the necessary equipment is integrated into on unit.

The Jet-500 requires 3-phase AC power for operation. The Voltage must be specified by the customer at the time of order. See the serial number/data plate on the machine for the voltage, current, and frequency specifications.

CO_2 pellets are produced by injecting CO_2 liquid into the pelletizer assembly where CO_2 snow is formed. CO_2 cannot exist as a liquid at normal storage temperature in normal atmospheric pressure. Thus, when it is released from the approximately 300psig storage pressure to ambient, it changes phase from liquid to solid (snow) and gas (exhaust). The snow is then compressed by the ram to form an ice cake. Additional advancement of the ram, forcing the ice cake through a die plate, forms many small ribbons of dry ice. These ribbons are cut into CO_2 pellets for blast cleaning operations. Optional die plates are available for a variety of pellet sizes and densities.

Section2. Parameter

Yield	LCO_2 Pressure	GCO2 Pressure	Pellet Size	Ratio	Power	Power Supply	Dimension
450-500Kg/hr	1.3-2.1Mpa	0.9-2.1Mpa	Φ 3mm Φ 9mm Φ16mm	≥40%	25kW	3 Phases 380V, 50HZ	1950X1100X2000 (mm)

Section 3. Safety

FROZEN! DANGER! -78℃!

NO BARE HAND CONTACT DRY ICE

APPROPRIATE PROTECTION MUST BE WEAR

Including but not limited to groves、goggle、mask ear-protection aids etc.

- Dip unit utilizes CO_2 in both liquid and gaseous states as a process along with CO_2 solids as an operational material.
- CO_2 is a naturally occurring gas in the atmosphere and is a normal by- product of animal metabolism. Green plants absorb CO_2 during the process of photosynthesis. CO_2 as a gas or solid material is non-toxic, non-poisonous, non-conductive and is an approved material for contact with food and beverages by the FDA
- While exposure to CO_2 gas is not harmful in the listed concentrations, **CAUTION:**

  MUST always be observed when using any material that can displace oxygen in the breathing environment.

  NEVER run this unit without the exhaust duct connected and always operate in well ventilated areas.

  NEVER exceed the recommended CO_2 concentration levels mandated by regulatory agencies or local company safety policies while operating
- CO2 solid are extremely cold and should not come into direct contact with skin or eyes (cover all areas of exposed skin when operating.)
- Before using this equipment, all operators and supervisors should familiarize themselves with the literature on the physiological characteristics of CO_2.

Section 4. Caution

4.1 Safety Requirements for Operation

The Dip pelletizer is a safe and easy unit to operate. However, certain precautions must be taken during its use.

- The unit should never be operated by unauthorized or untrained persons.
- Never expose unprotected skin to direct contact with CO_2 Pellets as the low temperature of the pellets can quickly result in burns and tissue damage of the skin.
- Never operate without protective clothing to cover all exposed skin. The clothing should be in multiple layers or approved to provide thermal protection.
- Never operate in a confined space without a ventilation system that maintains OSHA CO_2 concentration levels. CO2 gas can displace the oxygen from any breathing environment rapidly, depending upon conditions and room size.
- Never operate the unit without first reading the Operators Manual.
- When starting the units, observe all instruments and indicators to determine that they are within the specified ranges.
- Do not attempt to change the pressure settings or flow control rates of the unit, other than those made available to the operator. Any changes in these settings may lead to a system malfunction, performance loss or damage.
- Before leaving the unit, shut down the equipment according to the procedure.

4.2 Hose Safety Requirements

- When attaching the hoses or pipe fittings, always tighten them with the proper type of wrench or tool. Never operate the unit if the hoses or fittings have only been hand tightened.
- Always secure all attached hoses and interconnected hoses with the properly specified whip-check cords
- Before pressurizing any hose, always check to ensure that both ends of any hoses are attached properly. Never pull a trigger, turn on an air compressor or open a valve without checking the related hoses for proper attachment and safety equipment.
- Never attempt to tighten a pressurized line that may be “loose” or leaking.

Section5. Operating instruction

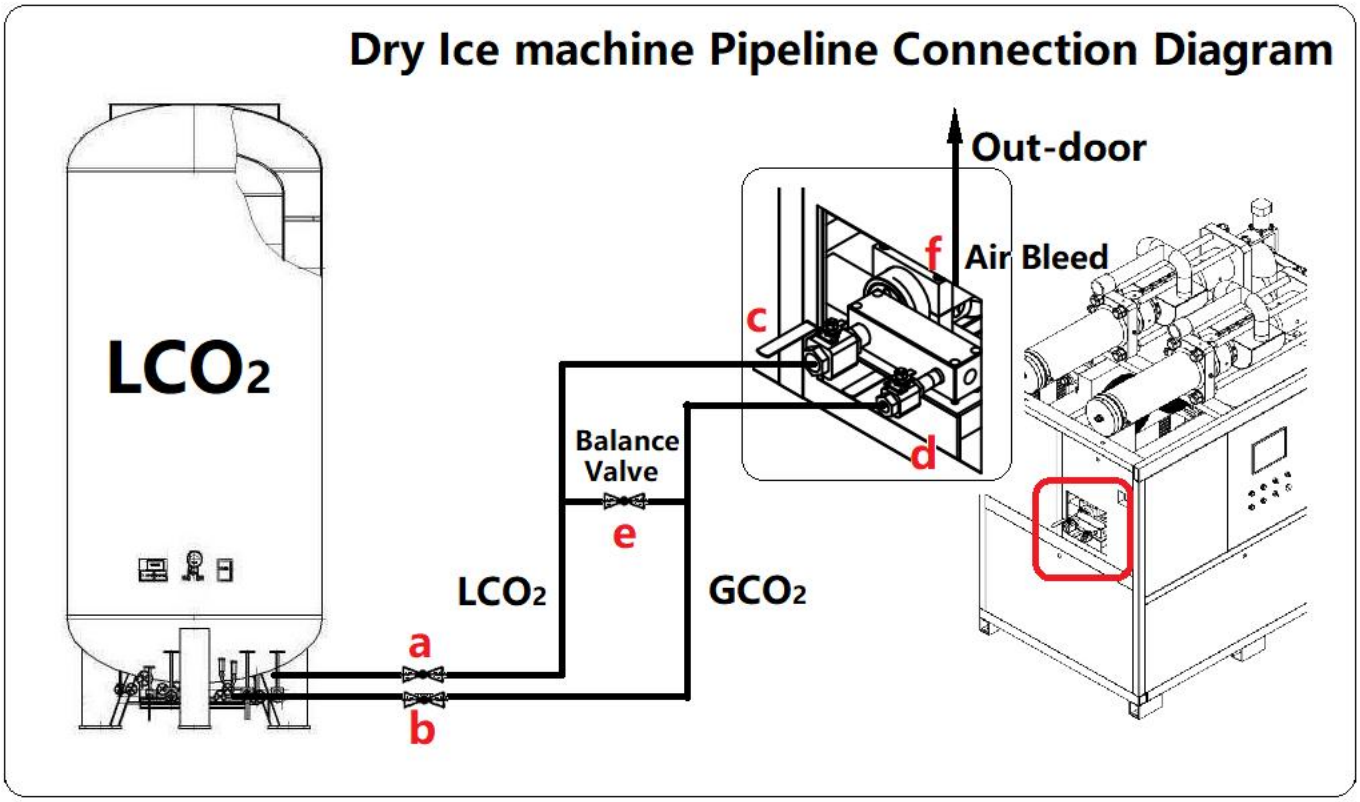

Figure 5-1 Pipeline Connection Diagram

Symbol	Name
#a	Liquid CO2 valve in plant piping system
#b	Vapor CO2 valve in plant piping system
#c	Liquid CO2 valve in machine
#d	Vapor CO2 valve in machine
#e	Balancing valve of LCO2 & GCO2 in piping system
#f	Air bleed valve

5.1 **Hydraulic Oil Added**

- Hydraulic oil MUST be added at the first.
- Open the pelletizer's back board, release the lid, observe the 2-in-1 level indicator to fill the hydraulic oil container full (~250-280L) with hydraulic oil. Refer to Figure 5.2.

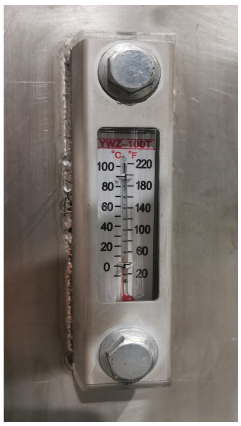

Figure 5.2

<u>Attention: Hydraulic oil recommend to be replaced up to 500 hr usage</u>

5.2 **Test Run**

- Test Runs means the test conducted respectively on the Hydraulic system and the entire equipment before the **FIRST USAGE** or **LONG TERM RESTART**, in order to check the mechanical performance.
- Use the key to open the circuit chest. Connect the circuit to the pellertizer. Refer to Figure 5.3 below.

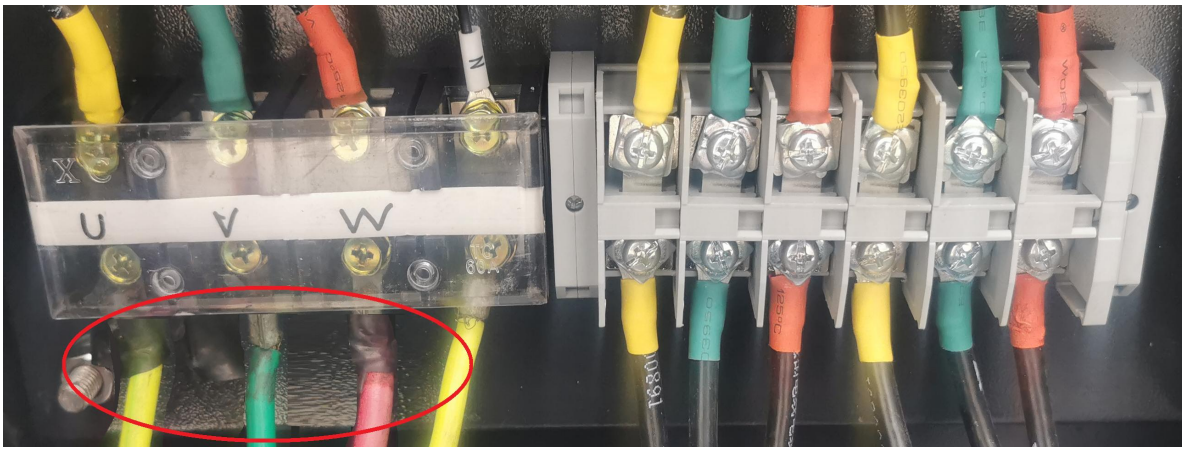

Figure5.3

➢ Plugged in the pelletizer and switched on the equipment by the button as shown in Figure 5.4.

Figure 5.4

➢ Release the **Emergency Stop** on the control panel, and then press the **Reset**. Refer to Figure 5.5. The manual mode is ON.

Figure 5.5

➢ **Start** the **Motor** in the circuit chest; adjust the **Back&Forward** of the Extrusion as shown in Figure 5.6, respectively. Examine if the movement of hydraulic extruder work properly.

Figure 5.6

➢ End the Test Run by switch the **Extrusion** to medium position. **Stop** the **Motor** in the circuit chest.

5.3 Start Up and Run

There are three valves （Figure 5.1, **#c #d #f)** on the side of the machine. All valves should be OFF.

5.3.1 Air Bleed Valve:

➢ OPEN the **VAPOR** valve (Figure 5.1，**# b**) installed in plant piping system to serve the equipment.

➢ In the machine, turn the **VAPOR & LIQUID** valves（Figure 5.1，**#c #d**）to the ON position. The pressure gauge is displayed.

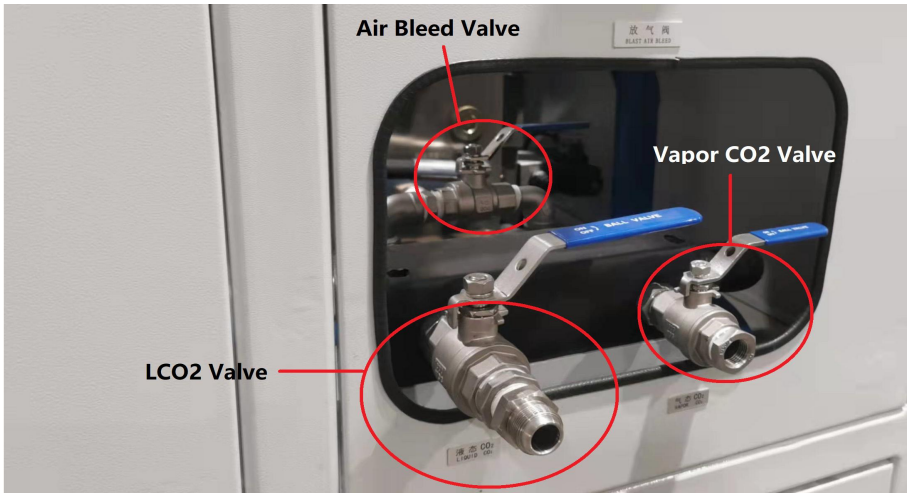

Figure5.7

➢ Open **Air BLEED** valve （Figure 5.1，**#f**）to release the air, and then turn the **AIR BLEED** & **LIQUID** valves（Figure 5.1，**#f #c**） OFF.

➢ OPEN the **Balance valve** （Figure 5.1，**#e**）installed in plant piping system for 3-5sec to balance the pressure, then turn the **Balance valve** （Figure 5.1，**#e**）OFF.

➢ OPEN the **Liquid valve** （Figure 5.1，**#a**）installed in plant piping system to serve the equipment.

Up to now, refer to Figure 5.1, check the status of the valves.

Symbol	Status
#a	ON
#b	ON
#c	OFF
#d	ON
#e	OFF
#f	OFF

5.3.2 Purge:

Automatically dries the interior of the snow barrel, exhaust screen, die plate, and injection nozzles of water condensation from the frost which thaws from the previous operation. The machine operates with vapor only in the liquid system for a number of complete cycles.

- Push the **RESET** button on control panel. Light ON.
- Push the **SYSTEM RUN** button on the control panel. Light FLASHING.
- The system will run for five cycles on extrusion cylinder. The FLASHING light is stopped when Purge is end.

5.3.3 Chill down:

The manual valves are shifted to also allow liquid CO_2 into the machine. The unit will gradually cool down, while operating at a reduced production rate for 3 cycles. The elbow blast jet will also operate to clear snow accumulation from the discharge elbow. During this period, the chamber pressure during each injection cycle will increase until the machine and the liquid supply line is thoroughly cooled. The reduced production rate is caused by alternate operation of the injector nozzles for 3 chill down cycles.

- Turn the **VAPOR** valve (Figure 5.1，**#d)** OFF.
- Turn the **LIQUID** valve (Figure 5.1，**#c)** ON
- Push the **RESET** button on the control panel. Light ON. The **SYSTEM RUN** signal Light FLASHING.
- The system will run for 3 cycles, and then PRODUCTION will start automatically.

Up to now, refer to Figure 5.1, check the status of the valves.

Symbol	Status
#a	ON
#b	ON
#c	ON
#d	OFF
#e	OFF
#f	OFF

5.3.4 Shutdown

- CLOSE the **LIQUID &VAPOR** valve (Figure 5.1，**#a #b)** installed in plant piping system to stop serve the equipment.
- Turn the **SYSTEM RUN** OFF after dry ice pellet stop coming out. Turn off the main power.
- Turn the **VAPOR BLEED** (Figure 5.1，**#f)** valve ON until the pressure gauge back to zero.
- Turn the **LIQUID, VAPOR & VAPOR BLEED** (Figure 5.1，**#c #d #f)** valve OFF

Refer to Figure 5.1, check the status of the valves.

Symbol	Status
#a	OFF
#b	OFF
#c	OFF
#d	OFF
#e	OFF
#f	OFF

5.4 Important Operating Information

5.4.1 During the production, when the **VAPOR** Value is ON, the **LIQUID** valve must be OFF.

5.4.2 The vapor purge cycle can be omitted if the machine is shut down for a short period of time after running for a long time, and if the pelletizer is still very cold. In general, however, it is always best to perform the full Vapor Purge Cycle each time you re-start the production.

5.4.3 In the case of the pressure in the storage tank excess 2.0mPa, the cylinders may sound "BOOM" like explosion. Adjust the **LIQUID** valve (Figure 5.1， **#c)** close 1/3 to 1/2, until the "BOOM" stopped.

5.4.4 Within 10% powder-like dry ice contain in the dry ice pellets & nuggets prodction is normal phenomenon. Excess amount may be caused by various resons, please contact our after-sales department for problem solving.

5.4.5 The production must be shut down in the case of the storage tank refilling process. Wait until the Liquid CO2 calm down in the tank, restart the production afterward.

Section6. 500 Hour Inspection

The purpose of the 500 hour inspection section is to familiarize you with the maintenance and inspection procedures as well as determining the service life of the CO_2 filter, exhaust screens, and wear rings. The useful life of these items can and will vary from one installation to another depending on the condition of the support equipment involved, including the age and condition of the CO_2 storage tanks. DIP considers that it is to your benefit to minimize down time and establish a periodic maintenance schedule based on your findings during the first 500hr inspection. A checklist follows to assist you in making these determinations.

6.1.Flow Meter

Turn On the VAPOR ON valve, VAPOR PURGE valve, and the machine SYSTEM ON/OFF switches. During the injection cycle the Flow Meter for the extrusion cylinder should suddenly rise to a steady value and drop suddenly to zero when the cycle is complete. If this does not happen, the Flow Meter have contaminant inside and must be removed, disassembled, cleaned, and re-installed.

6.2 Hydraulic System

With the LIQUID and VAPOR valves turned OFF, turn on the pelletizer and observe the pressure gauge on the Hydraulic Fluid Filter. The maximum pressure should not exceed 20psig. If the filter pressure is higher than 20psig, replace the filter element with a new one. For the first inspection, the filter must be changed. Check the hydraulic system overall for the following items:

- Security of electrical connections.
- Excessive oil leaks.
- The oil level should be just over half full on the sight gauge and a light amber in color. The oil should not have a cloudy appearance. If the oil looks cloudy, this indicates that moisture has combined with the oil, and the oil should be replaced before pump damage occurs.
- Clean the oil cooler radiator fins of dirt and debris. The fins are clogged; the oil temperature will rise to the point of shutting down the unit from high oil temperature.

6.3 Piston and Wear Ring Inspection

Remove the elbow, die and piston and measure the wearing ring thickness of rings.

Section7. Advance Maintenance

7.1 Extrusion Piston Removal and Replacement

This procedure should be performed only after the system is thawed out and allowed to rise back to normal ambient temperature. If this procedure is attempted on a “cold” pelletizer, the fasteners may be over-stressed and may become permanently damaged during the removal process.

This section also describes the removal and re-assembly of the pellet die plate, and die plate backing block. Refer to Figure7-1 below for the Extrusion Cylinder components.

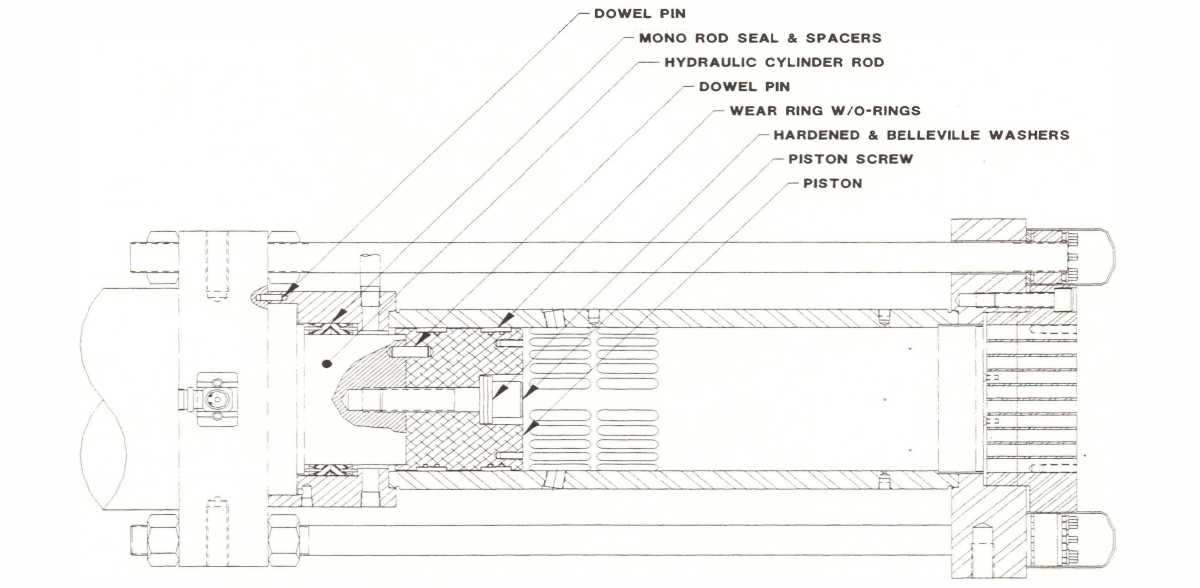

Figure 7-1 Extrusion Cylinder Components

7.1.1 Remove Pellet Extrusion Elbow by first removing the CO2 vapor hose connected to the Elbow,

7.1.2 Remove the four screws which attach the Extrusion Elbow to the Die Backing Block, and carefully remove the assembly and place it on a work surface to prevent damage.

7.1.3 To remove the Die Backing Block and Die Plate, remove the 16 M20 screws by initially loosening them by hand, and then spin them out with an impact wrench, if desired.

7.1.4 To prepare for the piston bolt removal, have a 17mm hex drive, 17mm socket, a break-over bar, and extension pipe ready for use.

7.1.5 Turn the pelletizer ON by using only the System ON / OFF switch of the side that is being serviced. The piston will move forward to the end of its stroke. Turn off the system, use the pre-assembled tools (Section 7.1.4.) to loosen the piston attachment bolt and remove it.

7.1.6 Install the Tee Handle tool with the two M10 bolts and pull the piston out of the bore. Remove the wear rings. Put the new wear rings in dry ice to froze for 30mins. Wipe the piston clean and install the pre-frozed new wear rings with the wear ring gaps **diametrically opposite** each other on the piston. The chamfered side of the piston rings should face toward the rod side of the piston for ease of installing the piston into the extrusion cylinder bore.

7.1.7 Before installing the piston attachment bolt, place the flat hardened washer into the piston counterbore, then place the two disc spring washers into the counterbore. Both disc springs should be placed with the “high” centers facing the head of the large attachment bolt. Prior to installing the disc springs, check them for extreme corrosion and / or cracking, and replace them with new disc springs if required. Tighten the large attachment bolt until the piston begins to rotate in the cylinder bore.

7.1.8 Refer to Figure 7-2, turn the System On / OFF switch ON, allow the piston to retract back into the cylinder, then turn the System On / OFF switch OFF.

Figure 7-2 Priston retracts into the cylinder

7.1.9 Check that the plastic strip “thermal barrier” at the front internal end of the extrusion cylinder is not deformed or damaged, then install the Die Block with four of the sixteen screws at the 12, 3, 6 and 9 o’clock positions. Hand tighten these screws to a “just snug" condition to insure that the Die Block is seated in the extrusion cylinder pilot bore. Install the remaining 16 screws and torque them to 200Nm., working back and forth across the diameter until the screw circle is completed.

7.1.10 Install the Extrusion Elbow and connect the proximity switch cable Run the pelletizer to cycle the piston to the rear or home position, checking for the proximity “red” illumination ON.

7.2 Tie Rods, Extrusion Cylinder, Mono-seals, Adapter Collar, and Hydraulic Cylinder Removal and Replacement

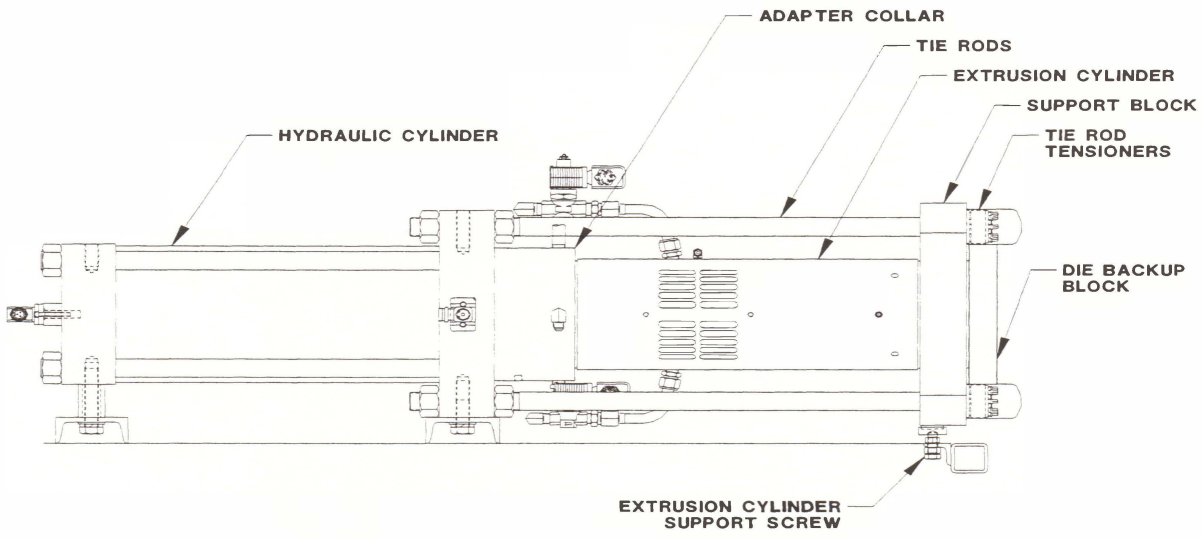

Figure 7-3 Hydraulic Extrude Assembly

Refer to Figure 7-3, above, for all procedures described in this section.

7.2.1 Remove the elbow and the die block as described in Section 7.1.

7.2.2 Loosen the piston bolt as described in Section 7.1.5, but leave it "just snug" in the piston.

7.2.3 Refer to Section 7.1.5. Turn the System 1 or 2 switch ON again to move the piston forward half of the stroke distance, stopping the piston movement at the mid-stroke point by pushing the Emergency Stop button of the control panel.

7.2.4 Loosen each small jack screw on each tensioner. Now move to the next "Superbolf tensioner diagonally across the extrusion cylinder, and repeat the procedure. It will require four full loosening circles around each of the tie rod tensioners to completely loosen the jackscrews to loosen the tensioners. See Figure 7-4 below for a pictorial description.

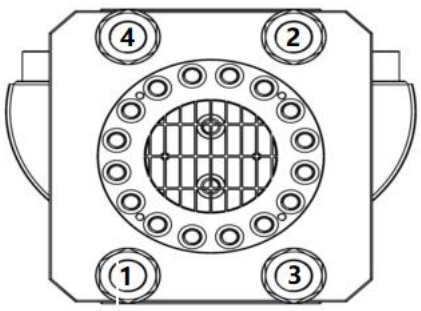

Figure 7-4 Tie Rod Tensioner

7.2.5 Remove the “Superbolt" tensioner assemblies, and, with two people, or one fork truck with a fork positioned through the center hole of the large rectangular Cylinder End Block, remove the Cylinder End Block and carefully place it on the floor near the pelletizer.

7.2.6 Remove the top and bottom injector tubes from the extrusion cylinder, as well as the two CO2 vapor purge hoses. Carefully slide the barrel off of the piston, with two people assisting each other to bring it down and place it safely on the floor. Use wooden boards as wedges to keep the cylinder from rolling.

7.2.7 Remove the loosened piston bolt, and remove the piston. The piston was left connected to the cylinder rod to prevent the extrusion cylinder from dropping on the cylinder rod and scratching it during the extrusion cylinder removal process.

7.2.8 Remove the three vent hoses and the vapor purge solenoid valve from the Adapter Collar. Insert two small chisels or screwdrivers between the Adapter Collar and the front of the hydraulic cylinder to gently pry the Adapter Collar forward, and off of the hydraulic cylinder.

7.2.9 There are two internal seals (Monoseals) which may, or may not, come out when the Adapter Collar is pulled forward and off of the hydraulic cylinder rod. Remove these seals for subsequent re-assembly, or for replacement with new seals if they are damaged. Each Monoseal has a stainless steel Backing Ring inserted into it. Inspect each ring for damage or twisting, and replace one ore both rings if necessary.

7.2.10 Refer to Section 7.1.5 and turn the pelletizer on to move the hydraulic cylinder rod to the fully extended position, stopping its motion by pushing the Emergency Stop button on the control panel. This reduces the amount of oil drainage when the front hydraulic cylinder bushing assembly is removed.

7.2.11 Remove the screws securing the Front Bushing to the hydraulic cylinder, then work the Front Bushing loose, and slide it off the hydraulic cylinder rod.

7.2.12 Behind the Front Bushing is the Main High Pressure Seal, which must be replaced if hydraulic oil is leaking from the front of the hydraulic cylinder. Drill two holes diametrically opposed to each other, 5mm deep, into the Main High Pressure Seal. Install a metal screw into each hole, and use these screws as pry points to remove the seal from the cylinder bore.

7.2.13 Wipe a film of hydraulic oil on the new seal and carefully work it into the cylinder bore as much as possible by hand. As the seating force becomes greater, use a rounded piece of wood (dowel) or other soft blunt tool to press on the lip of the seal while gently tapping on the front seal surface to seat the seal. Perform this very gently to avoid tearing the lip of new seal.

7.2.14 Remove and inspect the Bushing from the hydraulic cylinder Gland Housing. If the Bushing is not badly tom or appears to have layers of material missing from it, install back into the Gland Housing. Insure that all mating surfaces are clean. Reassemble the Front Bushing to the hydraulic cylinder, and install the attachment screws .

7.2.15 Assuming that new Monoseals will be installed in the Adapter Collar, proceed as follows: Install the wider of the two stainless steel Backing Rings over the cylinder rod, against the hydraulic cylinder, then slide one Monoseal, gap towards the hydraulic cylinder, onto the rod and all the way against the Backing Ring.

7.2.16 Install the narrower of the two Backing Rings into the Adapter Collar, and install the second Monoseal (gap towards the front o' the extrusion cylinder). Orient the Adapter Collar so that the locating pin matches the receiving hole, and slide the collar onto the hydraulic cylinder. Insure that the Adapter Collar is seated firmly against the face of hydraulic cylinder

7.2.17 Install the piston assembly onto the hydraulic cylinder rod, complete with o-rings or piston rings. Install the large piston attachment bolt, with the flat washers and disc springs, Tighten the bolt as much as possible prior to deadheading the hydraulic system. Refer to Section 7.1.7, etc.

7.2.18 Check large the nuts on the tie rods at the hydraulic cylinder end to insure that they are tight. This will keep the rods aligned properly to the extrusion cylinder as re-assembly proceeds. Check the “Superbolt” tensioners and make sure that all of the jack screws are backed off so that their ends are recessed into the bottom surface of the Super Bolt body.

7.2.19 Slide the extrusion cylinder onto the piston, and snug up against the Adapter Collar. Note the location of the extrusion cylinder Chamber Pressure Port, which should be at the 12 o'clock position.

7.2.20 Insure that the pilot bore in the Cylinder End Block is clear of debris, and slide it into position over the tie rod ends, and snugged up to the extrusion cylinder. Immediately install the "Superbolt" tensioners to prevent the Cylinder End Block from sliding off the tie rods. Now tighten the tie rod tensioners by hand until the Cylinder End Block is seated squarely on the end of the extrusion, with no wobble or play.

7.2.21 Refer to Figure 7-5 for the jack screw tightening sequences and patterns.

NOTE 1: The extrusion cylinder may not always align itself with the hydraulic cylinder rod and piston center-line. Check for the proper extrusion cylinder alignment by:
(1)Following the tie rod tensioning procedure above
(2)Moving the piston (exrending the piston) to about the half-way point of its stroke in the extrusion cylinder, and
(3)Checking the clearance between the piston and extrusion cylinder with a feeler gauge to determine if the extrusion cylinder is aligned too far up. down, right, or left (see Figure 7-5 below). When you have determined the alignment condition of the extrusion cylinder, back off the torque from all of the tie rod tensioners, per instructions in Section 7.24 Now, re-tighten and re-torque the tie rod tensioners in the sequence (1,2,3,4) shown in Figure 7-5 below for the condition of misalignment which you have determined. This is a time consuming procedure, but you must do this to avoid costly damage to your pelletizer.

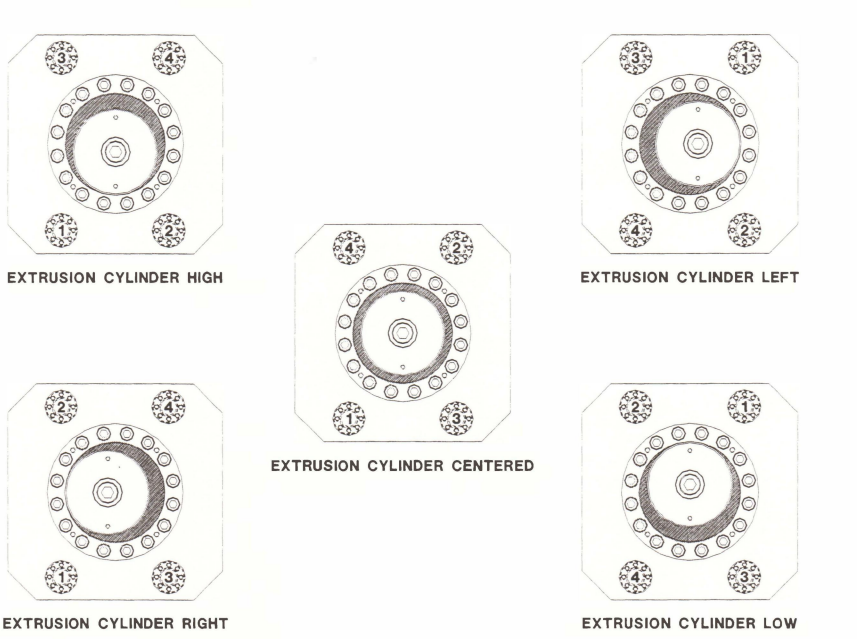

Figure 7-5 Extrusion Cylinder Allignment

NOTE 2: The specified tie rod tensioner torque is 4500Nm.

CAUTION: When tightening the jack-screws, cease tightening as soon as the torque wrench reaches the value. Do not continue to tighten the jack-screws until they stop turning, or serious over-load may occur to damage the tensioner or the tie rod. It is best to use the type of torque wrench which “clicks” when the value is obtained.

7.2.22 Adjust the Extrusion Cylinder Support Screw (refer back to Figure 7-4) until it seats against the large Support Block. Tighten the jam nut.

7.2.23 Install the Thermal Barrier plastic strip, the Die Plate and Die Backing Block assembly, and the Extrusion Elbow

7.2.24 Install the Exhaust Collectors, Liquid CO2 Injector assemblies, and Chamber Pressure switch hoses.

7.3 Hydraulic Pump Removal and Replacement

Turn OFF the Main Electrical Disconnect, lock it out, and fasten the lock-out key to the valve handle controlling the pump oil supply in the pump suction pipe at the bottom of the hydraulic oil reservoir. Turn OFF the pump suction line ball valve. Refer to Figure 7-6.

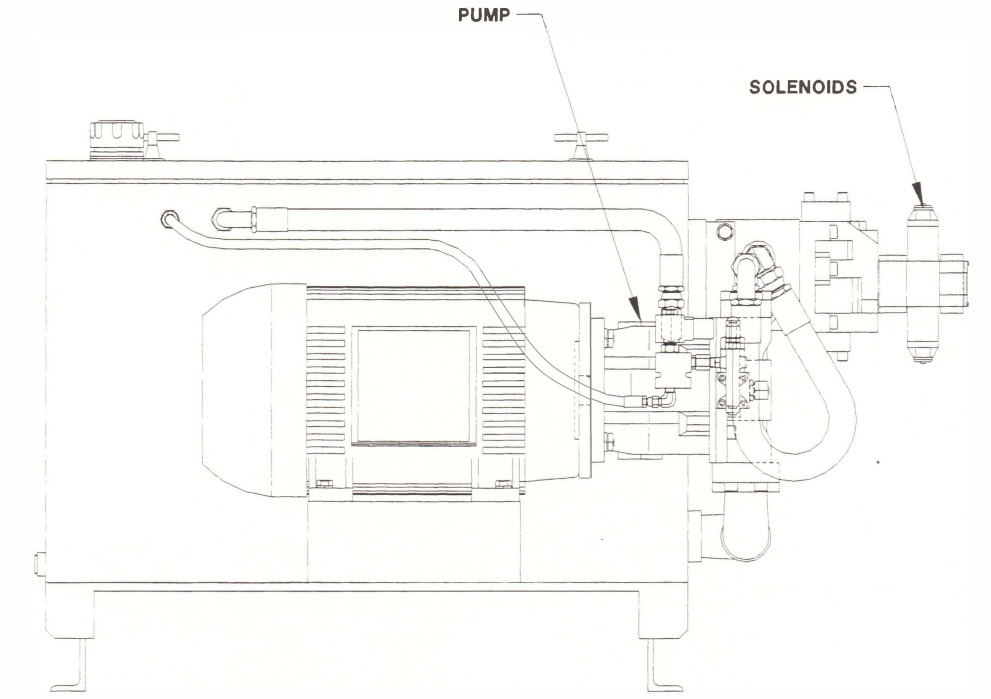

Figure 7-6 Hydraulic Pump and Hydraulic Directional Control Valves

7.3.1 Slide a metal or plastic pan underneath the pump to catch about 1-2L of oil which will drain from the pump when it is disconnected.

7.3.2 Remove the pressure discharge hose from the top of the pump.

7.3.3 Remove the four screws attaching the suction flange on the bottom of the pump (Do not attempt to loosen the suction hose). The oil will drain out of the pump during this procedure, so be sure the catch pan is positioned underneath the pump.

7.3.4 Remove the two small hoses attached to the side of the pump.

7.3.5 Remove the two hold-down screws at the pump flange to the motor adapter. The pump will slide out of the pilot hole. Caution: The pump weighs heavy, so care should be taken to prepare to lift the pump out of the pelletizer. This should be done by two people.

7.3.6 There is no field service for the pump except for changing external components to a new pump. The pump compensator valve assembly can be removed from the pump housing for re-installation on a new pump.

7.3.7 Check the elastomer spider bushing that connects the motor to the pump for severe abrasion or wear.

7.3.8 Installation of the pump is the reverse of the above procedures. Insure that all hydraulic fittings and hoses connected to the pump are clean and free of debris.

7.3.9 For the initial start-up of a new pump, “bump start" the pump by turning the pelletizer on in the normal manner, then immediately stopping the pelletizer by pressing the Emergency Stop button. This will insure that a full supply of oil enters the pump cavity prior to continuous running, to prevent potentially damaging pump cavitation.

7.3.10 If the hydraulic pump or hydraulic system requires further adjustment, refer to Section 7.5, below.

7.4 Checking the Hydraulic Directional Control Valve Solenoid Coils

7.4.1 The Coil(s) on the Hydraulic System Directional Control Valve(s) should indicate 33-35 Ω resistance. Check the resistance only with the pelletizer OFF, and the cable to the solenoid coil disconnected.

7.5 Baseline Hydraulic System Adjustment after Major Service

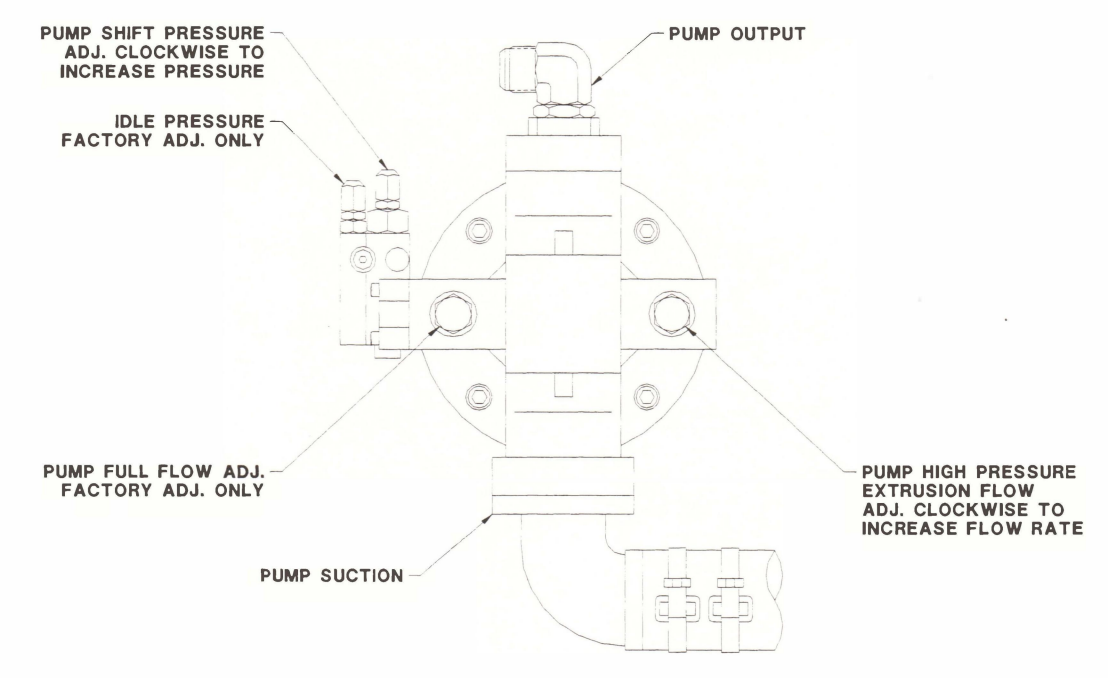

Figure 7-7 Hydraulic Pump Adjustment Points

7.5.1 Before starting the hydraulic system after servicing it, adjust the four Flow Restrictors to maintain a 0.5cm gap between the top of the locknut and the bottom of the cap screw head. They are located just below the Hydraulic System Directional Control Solenoid Valves on the Hydraulic System Manifold.

7.5.2 Prior to performing the following Hydraulic System adjustment procedures, the PPAH pelletizer should be operating (producing good quality pellets) for at least 25 minutes.

7.5.3 **Pump Shift Point Adjustment (High Flow Volume to Low Flow Volume).**

The pump shift point should be set between 1100 to 1200 psig. The pump shift point can be observed during the “piston advance" portion of the cycle as the piston begins to compress the CO2 "snow” in the extrusion cylinder. The Hydraulic Pressure Gauge will indicate a slight pause as the pressure increases through the 1100 - 1200 psig pump shift point If the pump shift point is adjusted too high, the pump will sound like it is slowing down at the end of the high pressure extrusion portion of the cycle. This apparent pump “slow down" occurs because the pump output pressure is set higher than the extrusion pressure required to force the last part of the compressed dry ice through the die plate holes at the very end of the extrusion cycle.

Example - The ending or lowest extrusion pressure required to extrude the very last part of the compressed CO2 “snow cake” is 1400 psig, but the pump shift point pressure is set at 1600 psig. This causes the pump to shift back to the "high flow - low pressure11 mode during the pellet extrusion process, instead of after the extrusion process is completed. The effect is to speed up the extrusion rate, producing chips and fines instead of pellets.

If the pump shift point occurs at too low a pressure, the piston advance into the CO2 "snow cake” for extrusion may exceed the normal 16 second period allowed for a normal pellet production rate, and the hourly production rate of pellets will diminish. The “pause” of the hydraulic pressure gauge as the pressure increases up may not even be noticeable if the pump shift point is set at too low a pressure.

Refer above to Figure 7-7. The Pump Shift Point Adjustment is found at the left rear side of the pump and is the right-most of the two vertical cap-nuts. The left cap-nut is the Pump Idle Pressure Adjustment. Do not adjust the Pump Idle Pressure! Turn the pelletizer hydraulic system OFF before removing the Pump Shift Point Adjustment cap-nut (The cap-nut is ISO “metric” size 16mm), With the lock nut loosened, turn the adjustment set screw clockwise to increase the shift point pressure or counterclockwise to reduce the shift point pressure.

Once the shift point pressure has been established, a 1/4 turn of the adjustment set screw in the proper direction (increased pressure or decreased pressure) will bring the pump shift point to its* proper value during the pelletizer operating cycle. Do NOT attempt to adjust the pump shift point during the high pressure extrusion portion of the cycle.

7.5.4 Pellet Extrusion Rate Adjustment.

The pellet extrusion portion of the operating cycle should take 7 to 8 seconds when the pelletizer is in the Production Mode (with both liquid CO2 injectors operating at the same time). The pelletizer will produce approximately 4-5kg of pellets per extrusion cycle. The extrusion cycle time is best determined using a stopwatch, starting when the hydraulic pressure indicates 1000 psig, and stopped when the front proximity switch indicator light changes to red. To adjust the extrusion cycle time interval, the pelletizer must be turned OFF to prevent a considerable loss of hydraulic oil. Remove the cap-nut from the right rear of pump and loosen the lock nut. Turn the extrusion rate adjustment set screw 1/2 turn clockwise to decrease the extrusion cycle time approximately 1 second. Turn the set screw counterclockwise 1/2 tum to increase the extrusion cycle time by 1 second. Install the cap-nut, and turn the pelletizer back ON. Push the RESET button until it stops flashing and becomes a steady light, then allow the pelletizer to run for at least three operating cycles and perform the extrusion rate adjustment procedure again, if required.

7.5.5 Maximum Hydraulic Pressure Adjustment

Located on the bottom side of the hydraulic manifold set screw. This is the Hydraulic Pressure Relief Valve； This device also controls the maximum pressure of the hydraulic unit

The maximum design pressure of the hydraulic system of the PPAH pelletizer is 3000 psig. The maximum pressure is normally set by the pump manufacturer at the factory, so the requirement for adjusting this setting in the field is rare. The maximum hydraulic pressure will be developed for 2 to 6 seconds during the pellet extrusion cycle. Any hydraulic oil volume that is not required to develop the extrusion pressure is automatically returned to the tank through the pressure relief valve. Oil passing through the pressure relief valve will become very hot, so it is very important that the oil cooler is free of dirt and debris, and the fan is operating. Without proper cooling, the hydraulic oil will overheat within an hour of pelletizer operation.

To decrease the maximum hydraulic pressure, loosen the lock nut and turn the set screw 1/2 turn counterclockwise. This can be performed anytime in the cycle except during the high pressure pellet extrusion portion. If required, turn the set screw clockwise to increase the maximum hydraulic pressure.

7.6 Adjusting the Hydraulic System to Maximize Pellet Output

7.6.1 Hydraulic Oil Flow Restrictor Adjustment

Before starting the pelletizer, the Flow Restrictors on the Directional Control Valve(s) must be adjusted. Loosen the jam-nut, and turn the Flow Restrictor Screw until a 0.5cm gap is measured between the top of the jam-nut and the bottom of the screw head, with the jam-nut fully tightened. See Figure 7-8 below.

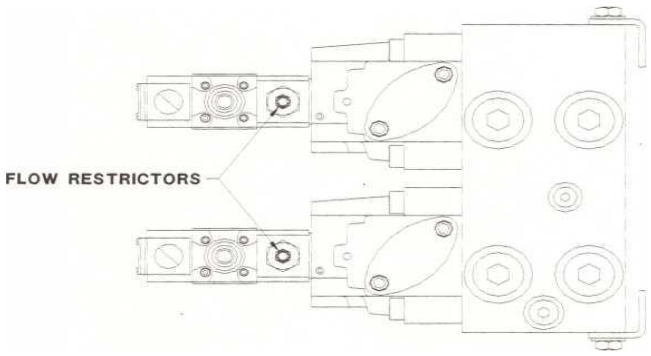

Figure 7-8 Hydraulic Flow Restrictors

7.6.2 Preliminary Requirements for Pump Adjustments

7.6.2.1 Allow the hydraulic system to run until the cooling fan comes on, indicating that the hydraulic fluid temperature has at least reached 37°C.

7.6.2.2 Operate the pelletizer until it is fully chilled down and producing good quality blasting pellets or dry ice nuggets. For adjusting the pump, install the die plate for the largest diameter dry ice product which you have (the 0.62 inch diameter nugget die plate is the largest). The full chill down should take about 25 to 35 minutes of pellet production.

7.6.3 Pump Shift Point Adjustment (High Flow to Low Flow)

Note the minimum extrusion pressure, which occurs at the end of the pellet extrusion cycle (before the hydraulic ram retracts). The pump shift point from high flow to low flow should occur at a pressure about 150 psig lower than the minimum extrusion pressure. If the shift point is already set higher than the minimum extrusion pressure, then the pump will shift back into high flow before the extrusion cycle is complete, and the pellets will "squirt" out of the die with accompanied by lots of fines and gas. If the pump shift point is already set lower than the minimum extrusion pressure, it may be difficult to tell exactly at what pressure the shift is occurring, so the shift point setting must be adjusted until the pellets squirt out of the die to provide a reference pressure point

Refer to Section 7.5.3 for the correct Pump Shift Point Adjustment procedure.