

# MODEL B2

## BACK PRESSURE REGULATOR

### SECTION I

#### I. DESCRIPTION AND SCOPE

The Model B2 is a back pressure regulator used to control upstream (inlet or  $P_1$ ) pressure. Sizes are 1/4" and 3/8" NPT (DN8 and DN10) FNPT or 1/2" (DN15) with Tri-Clamp connections. The unit is suitable for gaseous or liquid service. Refer to Technical Bulletin B2-TB for design conditions and selection recommendations.

#### ⚠ CAUTION

This is not a safety device and must not be substituted for a code approved pressure safety relief valve or a rupture disc.

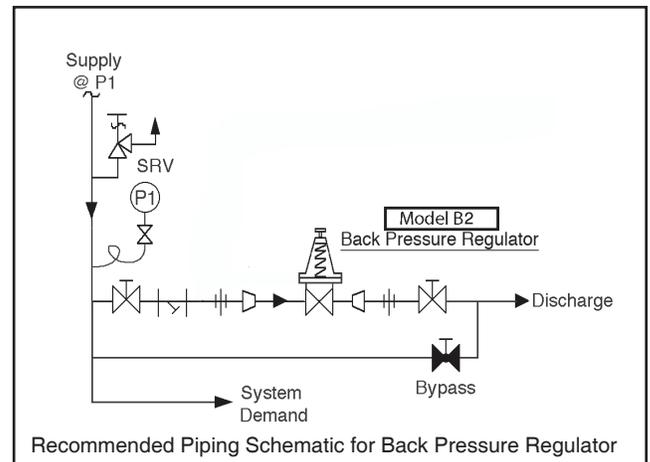
### SECTION II

#### II. INSTALLATION

#### ⚠ CAUTION

Installation of adequate overpressure protection is recommended to protect the regulator from overpressure and all downstream equipment from damage in the event of regulator failure.

1. An inlet block valve should always be installed.
2. If service application is continuous such that shutdown is not readily accomplished, it is recommended that an inlet block valve, outlet block valve, and a manual bypass valve be installed.
3. Pipe unions should be installed to allow removal from piping.
4. An inlet pressure gauge should be located approximately ten pipe diameters upstream, and within sight.
5. All installations should include a downstream relief device if the inlet pressure could exceed the pressure rating of any downstream equipment or the maximum outlet pressure rating of the unit.
6. Clean the piping of all foreign material including chips, welding scale, oil, grease and dirt before installing the regulator. Strainers are recommended.
7. In placing thread sealant on pipe ends prior to engagement, ensure that excess material is



- removed and not allowed to enter the regulator upon startup.
8. Flow Direction: Install so the flow direction matches the inlet stamp on the main regulator body (1).
9. For best performance, install in well drained horizontal pipe.
10. Basic Regulator - (Refer to Figure 2, Model B2): Regulator may be rotated around the pipe axis 360°. Recommended position is with knob (4) vertical upwards.
11. Regulators are not to be buried underground.
12. For insulated piping systems, recommendation is to not insulate regulator.

## SECTION III

### III. PRINCIPLE OF OPERATION

1. Movement occurs as pressure variations register on the diaphragm. The registering pressure is the inlet,  $P_1$ , or upstream pressure. The range spring opposes diaphragm movement. As inlet pressure drops, the range spring pushes the diaphragm down, closing

the port; as inlet pressure increases, the diaphragm pushes up and the port opens.

2. A complete diaphragm failure will cause the regulator to fail closed.

## SECTION IV

### IV. STARTUP



#### CAUTION

**The maximum inlet pressure is stamped on the body as the upper range spring pressure level, and is the recommended “upper operative limit” for the sensing diaphragm (see Section IV. Startup, Step 7). Higher pressures could damage the diaphragm. (Field hydrostatic tests frequently destroy diaphragms. DO NOT HYDROSTATIC TEST THROUGH AN INSTALLED UNIT; ISOLATE FROM TEST.)**

1. Start with the block valves closed. A bypass valve may be used to maintain inlet pressure in the upstream system without changing the following steps.
2. Relax the range spring (15) by turning knob (4) counter clockwise (CCW) a minimum of three (3) full revolutions. This reduces the inlet pressure setpoint.
3. If it is a “hot” piping system, and equipped with a bypass valve, slowly open the bypass valve to pre-heat the system piping and to allow slow expansion of the piping. Assure proper steam trap operation if installed. Closely monitor inlet (upstream) pressure via gauge to assure not over-pressurizing. **NOTE: If no bypass valve is installed, extra caution should be used in starting up a cold system; i.e. do everything slowly.**
4. Crack open the inlet (upstream) block valve.
5. Slowly open the outlet (downstream) block valve observing the inlet (upstream) pressure gauge. Determine if the regulator is flowing. If not, slowly rotate the regulator adjusting screw CCW until flow begins.

6. Continue to slowly open the outlet (downstream) block valve until fully open.
7. Observing the inlet (upstream) pressure gauge, rotate knob (4) clockwise (CW) slowly until the inlet pressure begins to rise. Rotate CW until the desired setpoint is reached.
8. Continue to slowly open the inlet (upstream) block valve. If the inlet (upstream) pressure exceeds the desired setpoint pressure, rotate knob (4) CCW until the pressure decreases.
9. When flow is established steady enough that both the outlet and inlet block valves are fully open, begin to slowly close the bypass valve, if installed.
10. Develop system flow to a level near its expected normal rate, and reset the regulator setpoint by turning knob (4) CW to increase inlet pressure, or CCW to reduce inlet pressure.
11. Using a downstream valve, reduce system flow to a minimum level and observe setpoint. Inlet pressure will rise from the setpoint of Step 9. (Ensure this rise does not exceed the stated upper limit of the range spring by greater than 50%, i.e. 2-50 psig (.14 - 3.4 Barg) range spring, at maximum flow the inlet pressure should not exceed  $1.5 \times 50$  psig (3.4 Barg), or 75 psig (5.2 Barg). If it does, consult factory).
12. Increase flow to maximum level, if possible. Inlet (upstream or  $P_1$ ) pressure should fall off. Readjust setpoint as necessary at the normal flow rate.

## SECTION V

### V. SHUTDOWN

1. On systems with a bypass valve, and where system pressure is to be maintained as the regulator is shut down, slowly open the bypass valve while closing the inlet (upstream) block valve. Fully close the inlet (upstream) block valve. (When on bypass, the system pressure must be constantly observed and manually

regulated. Close the outlet (downstream) block valve.



#### CAUTION

**Do not walk away and leave a bypassed regulator unattended.**

2. If the regulator and system are to both be shut down, slowly close the inlet (upstream) block

valve. Close the outlet (downstream) valve only if regulator removal is required.

## SECTION VI

### VI. MAINTENANCE

#### **WARNING**

**SYSTEM UNDER PRESSURE.** Prior to performing any maintenance, isolate the regulator from the system and relieve all pressure. Failure to do so could result in personal injury.

#### A. General:

1. Maintenance procedures hereinafter are based upon removal of the regulator unit from the pipeline where installed.
2. Owner should refer to owner's procedures for removal, handling, cleaning and disposal of nonreusable parts, i.e. gaskets, etc.
3. Refer to Figure 2 for Model B2 basic regulator and Figure 1 for the diaphragm subassembly.

#### B. Diaphragm Replacement - Model B2:

#### **CAUTION**

To prevent damage to body, use soft jaws when placing body in a vise. Position so that vise closes over the flats on lower end of body.

1. Securely install the body (1) in a vise with knob (4) directed upwards.

#### **WARNING**

**SPRING UNDER COMPRESSION.** Prior to removing spring chamber, relieve range spring compression by turning the knob CCW until rotation comes to a complete stop. Failure to do so may result in flying parts that could cause personal injury.

2. Relax range spring (15) by turning knob (4) CCW until rotation comes to a complete stop. **NOTE:** It is not necessary to remove the knob (4) before removing the spring chamber (6) from the body (1).
3. Remove spring chamber (6) by grasping the flats and turning CCW. Upon removal, the range spring (15), range spring clip (16), and spring button (5) should remain inside



**Figure 1:** Diaphragm Subassembly

the spring chamber.

4. Remove diaphragm subassembly (7) consisting of the actuator nut (7.3), diaphragm (7.1), actuator post (7.2), actuator gasket (7.4), actuator o-ring (7.5). Remove diaphragm gasket (10).
5. Remove actuator nut (7.3) and separate all parts of the diaphragm subassembly (7).
6. Clean body (1) diaphragm flange surface and all reusable parts according to owner's procedures. **Do not scratch diaphragm gasket seating surface.** **NOTE:** On regulators originally supplied as "oxygen clean", Option-M, maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. On regulators originally supplied for Sanitary Service, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.
7. Inspect and replace any necessary parts. **NOTE:** Use only parts manufactured and supplied by Cashco, Inc. for these products. See Section VIII.
8. Reassemble diaphragm subassembly (7) by placing the actuator gasket (7.4), diaphragm (7.1), and actuator o-ring (7.5) over the threads of the actuator post (7.2). Place a thread sealant compound on the threads of the actuator post (7.2) prior to installing the actuator nut (7.3). Install actuator nut (7.3) and tighten to the following torque value: **ALL SIZES:** 15 Ft-lbs (20 Nm).
9. Place the diaphragm gasket (10) onto the body (1) diaphragm flange. Place diaphragm subassembly on top of the gasket (10).

10. Lubricate the threads of the body (1) with a lightweight grease that is compatible with service use. Rotate the spring chamber (6) CW by hand onto the threaded portion of the body (1) until firmly seated against the diaphragm gasket (10). Tighten to the following torque value: **ALL SIZES:** 65–70 Ft lbs (88–95 Nm).
11. Pressurize with air and spray liquid leak detector around body (1) and spring chamber (6) to test for leakage. Ensure that an outlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 2-100 psig (.14-6.9 Barg) range spring, 51 psig (3.5 Barg) test pressure minimum.

### C. Trim Replacement:

1. Remove spring chamber subassembly and diaphragm subassembly per Section VI, Steps B.1.–B.4.
2. Remove seat retainer (13) and seat (12) by turning CCW.
3. Clean debris from within the body (1) cavity. Clean all parts to be reused according to owner's procedures. **NOTE:** *On regulators originally supplied as "oxygen clean", Option-M, maintenance must include a level of cleanliness equal to Cashco's cleaning standard #S-1134. On regulators originally supplied for Sanitary Service, maintenance must include a level of cleanliness equal to Cashco cleaning standard #S-1576. Contact factory for details.*

4. Inspect all parts for damage and replace if necessary. **NOTE:** *Use only parts manufactured and supplied by Cashco, Inc. for these products. See Section VIII.*
5. Install new seat retainer (13) with seat (12) into body (1) cavity with the seat (12) facing downward. Tighten seat retainer (13) to the following torque value: **ALL SIZES:** 6.25 Ft-lbs (8.47 Nm).
6. Reinstall diaphragm subassembly and spring chamber subassembly per Section VI, Steps B.9. – B.10.
7. Bench test unit for suitable operation. **NOTE:** *Regulators are not tight shutoff devices. Even if pressure builds up beyond set point, a regulator may or may not develop bubble tight shutoff.*
8. Pressurize with air and spray liquid leak detector around body (1) and spring chamber (6) to test for leakage. Ensure that an outlet pressure is maintained during this leak test of at least mid-range spring level; i.e. 2-100 psig (.14-6.9 Barg) range spring, 51 psig (3.5 Barg) test pressure minimum.

## SECTION VII

### VII. TROUBLE SHOOTING GUIDE

#### 1. Erratic operation; chattering.

| Possible Causes                                  | Remedies   |
|--|--|
| A. Oversized regulator; inadequate rangeability. | A1. Check actual flow conditions, re-size regulator for minimum and maximum flow.<br>A2. Increase flow rate.<br>A3. Decrease regulator pressure drop; decrease inlet pressure by placing a throttling orifice in inlet piping union.<br>A4. Install next step higher range spring.<br>A5. Before replacing regulator, contact factory. |

#### 2. Regulator inlet (upstream) too high.

| Possible Causes  | Remedies   |
|--|--|
| A. Regulator undersized.   | A1. Confirm by opening bypass valve together with regulator.<br>A2. Check actual flow conditions, re-size regulator; if regulator has inadequate capacity, replace with larger unit. |
| B. Incorrect range spring (screwing in CW of adjusting screw does not allow bringing pressure level up to proper level). | B. Replace range spring with proper lower range.   |
| C. Too much rise (build).  | C1. Review rise (build) expected.<br>C2. Contact factory.  |

#### 3. Sluggish operation.

| Possible Causes       | Remedies                        |
|-----------------------|---------------------------------|
| A. Fluid too viscous. | A. Heat fluid. Contact factory. |

## SECTION VIII

### VIII. ORDERING INFORMATION NEW REPLACEMENT UNIT vs PARTS "KIT" FOR FIELD REPAIR

To obtain a quotation or place an order, please retrieve the Serial Number and Product Code that was stamped on the metal name plate and attached to the unit. This information can also be found on the Bill of Material ("BOM"), a parts list that was provided when unit was originally shipped. (Serial Number typically 6 digits). Product Code typical format as follows: (last digit is alpha character that reflects revision level for the product).

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#### NEW REPLACEMENT UNIT:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. With this information they can provide a quotation for a new unit including a complete description, price and availability.

#### PARTS "KIT" for FIELD REPAIR:

Contact your local Cashco, Inc., Sales Representative with the Serial Number and Product code. Identify the parts and the quantity required to repair the unit from the "BOM" sheet that was provided when unit was originally shipped.

**NOTE:** *Those part numbers that have a quantity indicated under "Spare Parts" in column "A" reflect minimum parts required for inspection and rebuild, - "Soft Goods Kit". Those in column "B" include minimum trim replacement parts needed plus those "Soft Goods" parts from column "A".*

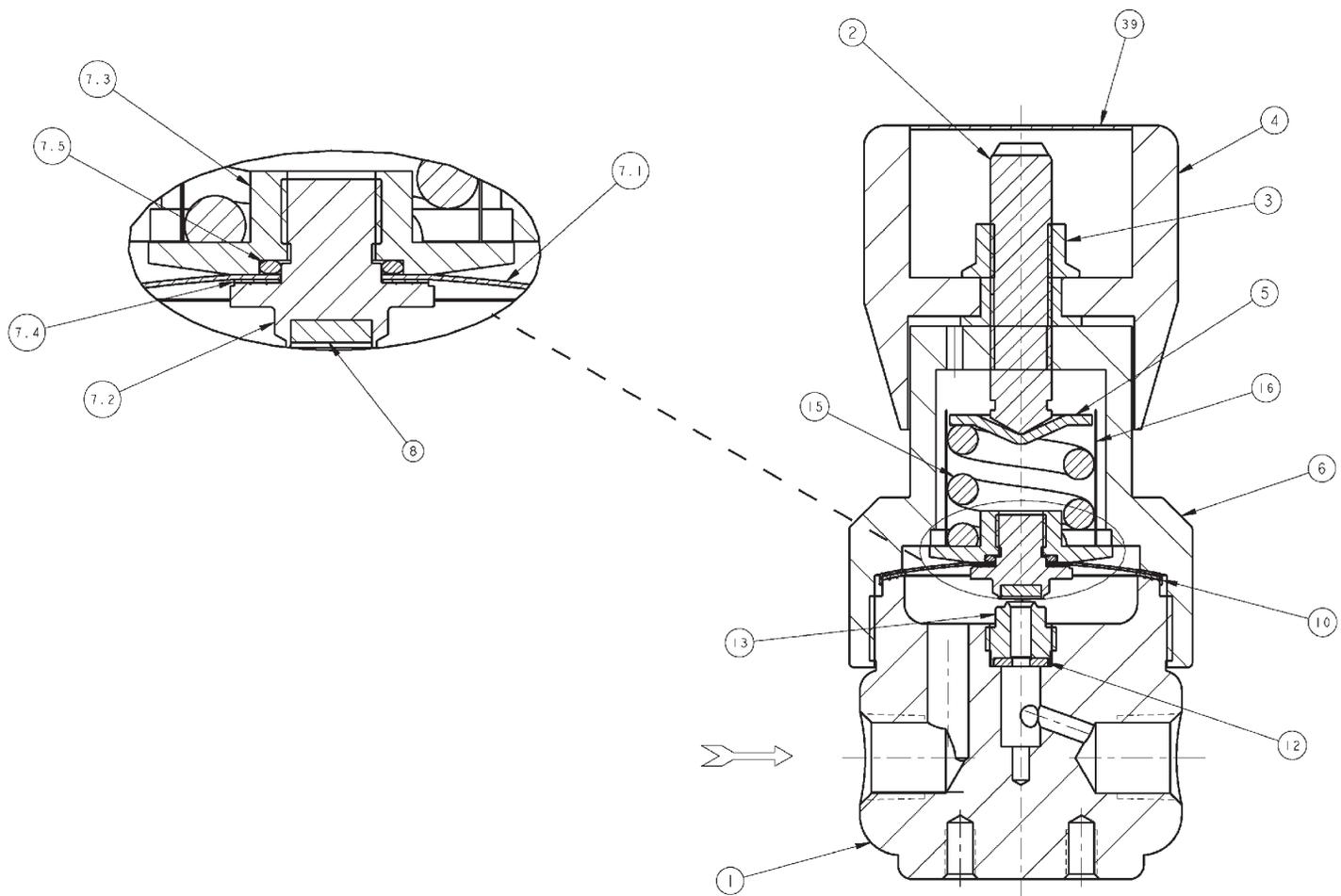
If the "BOM" is not available, refer to the cross-sectional drawings included in this manual for part identification and selection.

A Local Sales Representative will provide quotation for appropriate Kit Number, Price and Availability.



#### **CAUTION**

**Do not attempt to alter the original construction of any unit without assistance and approval from the factory. All purposed changes will require a new name plate with appropriate ratings and new product code to accommodate the recommended part(s) changes.**



**Figure 2: Model B2**

| Item No. | Description                    | Repair Parts Kit B |
|----------|--------------------------------|--------------------|
| 1        | Body                           |                    |
| 2        | Adjusting Screw                |                    |
| 3        | Knob Nut                       |                    |
| 4        | Knob                           |                    |
| 5        | Spring Button                  |                    |
| 6        | Spring Chamber                 |                    |
| 7        | Diaphragm Subassembly          |                    |
| 7.1      | Diaphragm -----                | ‡‡                 |
| 7.2      | Actuator Post with Seat (#8)-- | ‡‡                 |
| 7.3      | Actuator Nut                   |                    |
| 7.4      | Actuator Gasket -----          | ‡‡                 |
| 7.5      | Actuator O-ring -----          | ‡‡                 |
| 10       | Diaphragm Gasket -----         | ‡‡                 |
| 12       | Seat -----                     | ‡‡                 |
| 13       | Seat Retainer -----            | ‡‡                 |
| 15       | Range Spring                   |                    |
| 16       | Spring Clip                    |                    |
| 21       | Inline Filter-----             | ‡‡                 |
| 39       | Snap in cover                  |                    |
| ‡‡       | Recommended Spare Part         |                    |

## ATEX 2014/34/EU: Explosive Atmospheres and Cashco Inc. Products



Cashco, Inc. declares that the products listed in the table below has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II of the ATEX Directive 2014/34/EU. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN ISO 80079-36:2016 and EN ISO 80079-37:2016. The product will be marked as follows:

CE Ex II 2 G  
Ex h IIB T6... T1 Gb  
1000ATEXR1 X

The 'X' placed after the technical file number indicates that the product is subject to specific conditions of use as follows:

1. The maximum surface temperature depends entirely on the operating conditions and not the equipment itself. The combination of the maximum ambient and the maximum process medium temperature shall be used to determine the maximum surface temperature and corresponding temperature classification, considering the safety margins described prescribed in EN ISO 80079-36:2016, Clause 8.2. Additionally, the system designer and users must take precautions to prevent rapid system pressurization which may raise the surface temperature of system components and tubing due to adiabatic compression of the system gas. Furthermore, the Joule-Thomson effect may cause process gases to rise in temperature as they expand going through a regulator. This could raise the external surface temperature of the regulator body and the downstream piping creating a potential source of ignition. Whether the Joule-Thomson effect leads to heating or cooling of the process gas depends on the process gas and the inlet and outlet pressures. The system designer is responsible for determining whether the process gas temperature may raise under any operating conditions.
2. Where the process medium is a liquid or semi-solid material with a surface resistance in excess of  $1G\Omega$ , special precautions shall be taken to ensure the process does not generate electrostatic discharge.
3. Special consideration shall be made regarding the filtration of the process medium if there is a potential for the process medium to contain solid particles. Where particles are present, the process flow shall be  $<1\text{m/s}$  ( $<3.3\text{ ft/s}$ ) in order to prevent friction between the process medium and internal surfaces.
4. Effective earthing (grounding) of the product shall be ensured during installation.
5. The valve body/housing shall be regularly cleaned to prevent build up of dust deposits.
6. Regulators must be ordered with the non-relieving option (instead of the self-relieving option) if the process gas they are to be used with is hazardous (flammable, toxic, etc.). The self-relieving option vents process gas through the regulator cap directly into the atmosphere while the non-relieving option does not. Using regulators with the self-relieving option in a flammable gas system could create an explosive atmosphere in the vicinity of the regulator.
7. Tied diaphragm regulators with outlet ranges greater than 7 barg (100 psig) should be preset to minimize the risk that improper operation might lead to an outboard leak and a potentially explosive atmosphere.
8. All equipment must only be fitted with manufacturer's original spare parts.
9. Ensure that only non-sparking tools are used, as per EN 1127-1, Annex A.

|                        | PRODUCT  |
|------------------------|--|
| <b>REGULATORS</b>      | 31-B, 31-N   |
|                        | 1164, 1164(OPT-45)   |
|                        | 1171, 1171(OPT-45), 1171(CRYO)   |
|                        | 2171, 2171(OPT-45), 2171(CRYO), 3171                                     |
|                        | 1465, 3381, 3381(OPT-45), 3381(OPT-40)                                   |
|                        | 4381, 4381(OPT-37), 4381(CRYO), 4381(OPT-45), 5381                       |
|                        | MPRV-H, MPRV-L   |
|                        | PBE, PBE-L, PBE-H  |
|                        | CA-1, CA-2   |
|                        | CA1, SA1, CA4, SA4, CA5, SA5   |
|                        | DA2, DA4, DA5, DA6, DA8  |
|                        | DA0, DA1, DAP, SAP   |
|                        | SLR-1, SLR-2, PTR-1  |
|                        | ALR-1, ULR-1, PGR-1  |
|                        | BQ, BQ(OPT-45), BQ(CRYO)   |
|                        | 123, 123(CRYO), 123(OPT-45), 123(OPT-46G)                                |
|                        | 123-1+6, 123-1+6(OPT-45), 123-1+6(OPT-46G), 123-1+6+S, 123-1+6+S(OPT-40) |
|                        | 1000HP, 1000HP(OPT-37), 1000HP(OPT-45), 1000HP(OPT-45G), 1000HP(CRYO)    |
|                        | 1000HP-1+6, 1000HP-1+8, 1000LP, 1000LP(OPT-45), 1000LP(OPT-46G)          |
|                        | 6987   |
|                        | 8310HP, 8310HP-1+6, 8310HP-1+8, 8310LP, 8311HP, 8311LP                   |
|                        | 345, 345(OPT-45)   |
|                        | BA1/BL1, PA1/PL1   |
|                        | C-BPV, C-PRV, C-CS   |
|                        | D, D(CRYO), D(OPT-37), D(OPT-20), D(OPT-45)                              |
|                        | DL, DL(LCC), DL(OPT-45)  |
|                        | BR, BR(CRYO)   |
|                        | HP, HP(LCC), HP(OPT-45), HP(OPT46G), HP-1+6+S(OPT-40), HP-1+6+S          |
|                        | P1, P2, P3, P4, P5, P7   |
|                        | B2, B7   |
|                        | POSR-1, POSR-2   |
|                        | 5200P, 5300P   |
|                        | 135  |
| NW-PL, NW-SO           |  |
| CG-PILOT               |  |
| FG1                    |  |
| <b>CONTROL VALVES</b>  | RANGER, 987, PREMIER   |
|                        | 964, 521, 988, 988-MB, 989   |
|                        | 2296/2296HF  |
|                        | SCV-30, SCV-S  |
|                        | FL800/FL200  |
| <b>TANK BLANKETING</b> | 8700, 8910, 8920, 8930, 8940   |
|                        | 2100, 2199   |
|                        | 3100, 3200, 3300, 3400, 3500, 3600, 3700                                 |
|                        | 1078, 1088, 1100, 1049   |
|                        | 5100, 5200, 5400, 5500   |
|                        | 4100, 4200, 4300, 4400, 4500, 4600                                       |
| <b>MISC</b>            | 764P/PD, 764-37, 764T  |

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