

September 11, 2023

TSSA
345 Carlingview Drive
Toronto, ON M9W 6N9

Dear Cecylia Garbacz,

Re: Reciprocal CRN Registration in Manitoba

As indicated by the Regulatory Reconciliation and Cooperation Table and the Reconciliation Agreement for the Canadian Registration Number (CRN) for Pressure Equipment, the design reviews conducted and accepted by the Canadian province or territory, or their delegated safety authority, will be mutually recognized in the Province of Manitoba. If a registration is conditionally based on compliance with the notes set by the original issuing Jurisdiction, such compliance shall be applied the same to this Province.

Your submission has been registered, as follows:

File Number: 74-R3465
CRN: 0C16304.54
Scope: RENEWAL OF SERIES K PRESSURE REGULATORS. See the attachment
A and B for scope of registration
Manufacturer: SWAGELOK
Expiry Date: 15 August 2033

Along with this letter is the invoice for registration.

In addition, every Pressure Vessel, Boiler, and Heat Exchanger shall be stamped with the registration number and as required by CSA Code B51, a Manufacturer's Data Report (MDR) must be forwarded to this office immediately at the time a unit is shipped to Manitoba. Send your MDR to gasupport@gov.mb.ca. In your subject line, indicate "*Manufacturer's Data Report-CRN No.*" A fee shall be billed to the Manufacturer to process data reports in accordance with the Steam and Pressure Plants Regulation section 17.1.

Please contact gasupport@gov.mb.ca for any questions or concerns.

Inspection and Technical Services
Labour and Immigration
508 – 401 York Avenue, Winnipeg, MB R3C 0P8
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CRN Compliance Summary

K Series Pressure Regulators

1.0 SCOPE

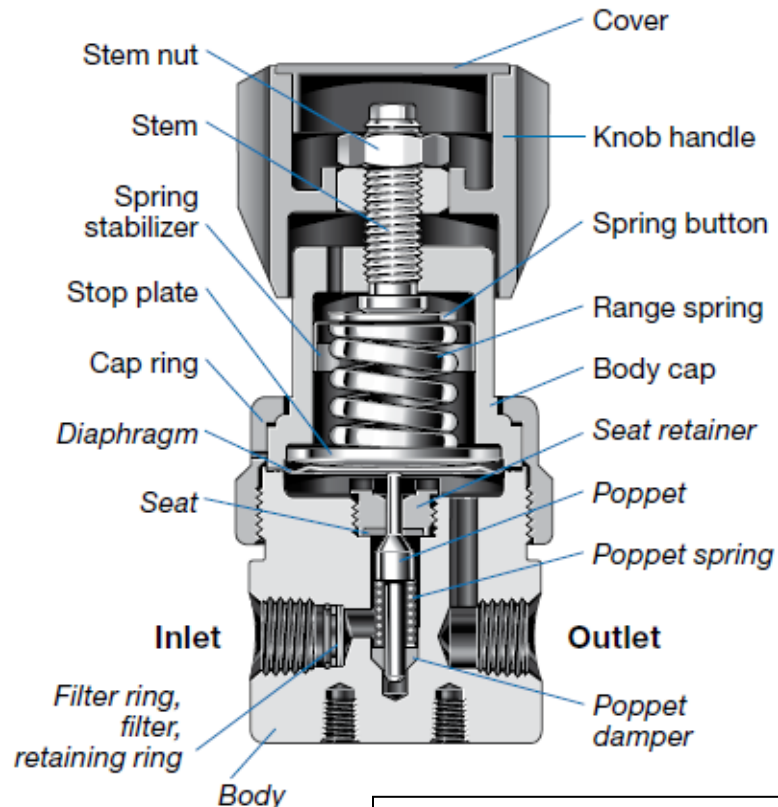
The Swagelok K Series Pressure Regulators comply with the requirements of ASME B31.1-2022 "Power Piping" as an unlisted component per Section 104.7.2 and ASME B31.3-2022 "Process Piping" as an unlisted component per Section 304.7.2.

Compliance is supported by:

- Material properties and allowable stress values from ASME B31.1 Table A-3, ASME B31.3 Table A-1 and independent lab testing.
- Design calculations consistent with the design criteria of ASME B31.3-2022 Section 304.7.2 for minimum wall thickness and ANSI B1.1 Appendix B for thread strength.

2.0 PRODUCT DESCRIPTION AND RATINGS

Figure 1 – K Series Pressure Regulators



Note:
"KPR" regulator shown,
cross-sections for the other
models can be found in the
product catalog.

CRN Compliance Summary

K Series Pressure Regulators

| Product Series | Material | Maximum Working Pressure Rating from 0 to 100°F (psig) | | Maximum Rated Temperature (°F) | Maximum Working Pressure at Temperature Rating (psig) | |
|-----------------|-----------|--|--------|--------------------------------|---|--------|
| | | Inlet | Outlet | | Inlet | Outlet |
| KPR | SS 316 | 6000 | 500 | 392 | 3600 | 500 |
| | Brass | 3600 | 500 | 392 | 3600 | 500 |
| | Monel | 3600 | 500 | 392 | 3600 | 500 |
| | Hastelloy | 3600 | 500 | 392 | 3600 | 500 |
| KCY | SS 316 | 6000 | 500 | 392 | 3600 | 500 |
| | Brass | 3600 | 500 | 392 | 3600 | 500 |
| | Monel | 3600 | 500 | 392 | 3600 | 500 |
| | Hastelloy | 3600 | 500 | 392 | 3600 | 500 |
| KCM | SS 316 | 3600 | 500 | 392 | 3600 | 500 |
| KLF | SS 316 | 3600 | 250 | 392 | 3600 | 250 |
| KHF | SS 316 | 3600 | 250 | 392 | 3600 | 250 |
| KCP | SS 316 | 3600 | 1500 | 392 | 3600 | 1500 |
| KPP | SS 316 | 6000 | 3000 | 392 | 6000 | 2975 |
| KPF | SS 316 | 6000 | 4000 | 392 | 6000 | 4000 |
| KHP | SS 316 | 10000 | 8000 | 392 | 10000 | 8000 |
| KHR | SS 316 | 10000 | 8000 | 212 | 10000 | 8000 |
| KBP | SS 316 | 500 | 500 | 392 | 500 | 500 |
| KFB | SS 316 | 250 | 250 | 392 | 250 | 250 |
| KCB | SS 316 | 375 | 375 | 392 | 375 | 375 |
| KPB | SS 316 | 3000 | 3000 | 392 | 2975 | 2975 |
| KHB | SS 316 | 8000 | 8000 | 212 | 8000 | 8000 |
| KEV (diaphragm) | SS 316 | 3600 | 500 | 392 | 3600 | 500 |
| KEV (piston) | SS 316 | 3600 | 3000 | 392 | 3600 | 2975 |
| KSV | SS 316 | 3600 | 500 | 392 | 3600 | 500 |

3.0 MATERIALS

3.1. Material Standards and Properties

The materials of construction for pressure-containing components of the Swagelok K Series Pressure Regulators are listed in the table below. These are the only materials used for the pressure-retaining components. The table below gives the maximum allowable stress values. The source of these values is provided in the table.

3.2. Minimum Design Metal Temperature (MDMT)

The MDMT for the materials of construction is listed in the table below. The temperature rating of all the pressure regulators listed in the Scope Document is significantly higher in temperature than any of the MDMT's listed below.

CRN Compliance Summary

K Series Pressure Regulators

Material Standards and Allowable Stress Values

| Component | Material Type & Form | UNS Number / Material Standard | ASME B31.1 or ASME B31.3 code listing | Allowable Stress Source | Tensile Strength | | Minimum Design Metal Temperature °F (°C) |
|-----------|----------------------------------|--------------------------------|---------------------------------------|-------------------------|--|---|---|
| | | | | | Max Allowable Stress (psi) at 0 to 100°F | Max Allowable Stress (psi) at rated temperature | |
| Body | Stainless Steel 316 Annealed Bar | S31600 / ASTM A479 | listed | ASME B31.1 Table A-3 | 20,000 | 19,356 | -325 (-198.3) |
| Body Cap | | | | | | | |
| Cap Ring | | | | | | | |
| Body | Brass Annealed Bar | C67500 / ASTM B138 | unlisted | ASTM B138 (Note 1) | 14,667 | 9,600 | -452 (-268.9) |
| Body Cap | | | | | | | |
| Cap Ring | | | | | | | |
| Body | Alloy 400 Annealed Bar | N04400 / ASTM B164 | listed | ASME B31.3 Table A-1 | 26,600 | 23,972 | -325 (-198.3) |
| Body Cap | | | | | | | |
| Cap Ring | | | | | | | |
| Body | Alloy C-276 Annealed Bar | N10276 / ASTM B574 | listed | ASME B31.3 Table A-1 | 27,300 | 27,300 | -325 (-198.3) |
| Body Cap | | | | | | | |
| Cap Ring | | | | | | | |

Notes:

- (1) The guidelines per ASME B31.1, Section 123.1.2 Unlisted Materials and ASME B31.3, Section 323.1.2, Unlisted Materials, were followed, whereby materials may be used “provided they conform to a published specification covering chemistry, physical and mechanical properties, method and process of manufacture, heat treatment and quality control and otherwise meet the requirements of this Code. Allowable stresses shall be determined in accordance with the applicable allowable stress basis of this Code or a more conservative basis.” The Allowable Stress shown in the above table is the lowest value based on these code requirements: (1) ASME B31.1 Section 102.3.1(c) which redirects to ASME B&PVC Section II Part 2D Appendix 1: the lesser of minimum tensile strength divided by 3.5 or two-thirds of the yield stress or (2) ASME B31.3 Section 302.3.2(d): the lesser of one-third of the tensile strength or two-thirds of the yield strength. The brass bar material properties at the product’s temperature rating were determined through testing at an independent lab. A copy of the test report is attached as Appendix E. The ratio of the tested tensile strength at the rated temperature divided by the tested tensile strength at room temperature was multiplied times the allowable stress at room temperature to calculate the allowable stress at the rated temperature.
- (2) The MDMT’s provided in the above table are significantly lower than the temperatures intended for use of these products. Please note that these values are not minimum temperature ratings for these products.

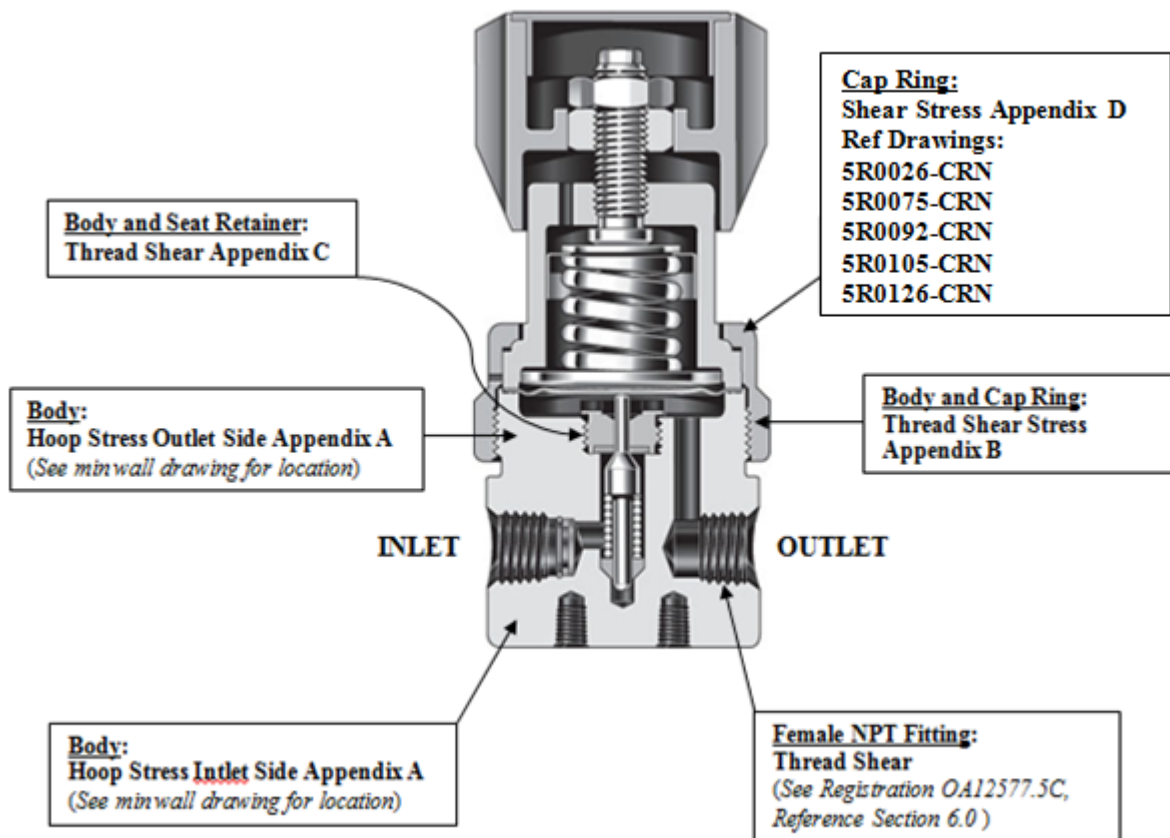
CRN Compliance Summary

K Series Pressure Regulators

4.0 STRESS ANALYSIS

- 4.1. Stress calculations are included in Appendices A, B, C and D and illustrated on the drawing below for the following:
- 4.1.1. Appendix A – Body hoop stress at the minimum wall locations on the inlet and outlet sides of the pressure regulators. The minimum wall locations are shown on the drawings included with this application.
 - 4.1.2. Appendix B – Body and Cap Ring thread shear stress
 - 4.1.3. Appendix C – Body and Seat Retainer thread shear stress
 - 4.1.4. Appendix D – Cap Ring shear stress on the shoulder that is retaining the pressure load on the sensing element (either diaphragm or piston).

Figure 1 – K Series Pressure Regulators Stress Calculations
(KPR Model shown)



CRN Compliance Summary

K Series Pressure Regulators

4.2. The calculated hoop stress for all of the pressure regulators was less than the allowable stress for each of the models and raw materials see Appendix A for the calculations. The hoop stress of the body is derived from equations below depending on the relationship of the wall thickness to the diameter:

S_H = hoop stress
 P = maximum rated pressure
 D_o = maximum outside diameter
 t_{min} = minimum wall thickness
Tangential Hoop Stress- Thin Wall

The following formulas apply for the following condition: **Thin Wall** $\frac{2D_o}{2t_{min}} > 6$

$$S_H = P \frac{d_{max} + 0.6(2t_{min})}{2t_{min}} \quad \text{Or} \quad S_H = P \frac{D_o - 0.4(2t_{min})}{2t_{min}}$$

ASME B31.1 equation 104.1.2(4A) Neglecting corrosion factor A (responsibility of end customer)
ASME B31.3 equation 304.1.2(3B)

Tangential Hoop Stress- Thick Wall

The following formulas apply for the following condition: **Thick Wall** $\frac{2D_o}{2t_{min}} < 6$

$$S_H = P \frac{d_{max} + 2t_{min} \left[1 - \left(\frac{d_{max}}{2d_{max} + 2t_m} \right) \right]}{2t_{min}} \quad \text{Or} \quad S_H = P \frac{D_o - 2t_{min} \left[\frac{D_o - 2t_m}{2D_o - 2t_m} \right]}{2t_{min}}$$

ASME B31.1 Table 104.1.2(A) Note B where $y = \frac{d_{max}}{d_{max} + D_o}$

ASME B31.3 equation 304.1.2(b)

4.3. The calculated thread shear stress for all of the pressure regulators was less than the allowable stress for each of the models and raw materials see Appendix B and Appendix C for the calculations.

4.3.1. Per ASME B31.3, Section 302.3.1(b), the maximum allowable stress in shear is 0.8 times the allowable tensile stress.

4.3.2. Average Shear Stress on the female threads in the body that retain the end screw is calculated using the standard stress equation, where the thread shear

CRN Compliance Summary

K Series Pressure Regulators

cylinder diameter is calculated using the first equation in section B2 in Appendix B of ANSI B1.1:

$$SS_n = \frac{PA}{AS_n} = \frac{P\left(\frac{\pi}{4}d_{\max}^2\right)}{AS_n} \quad \text{where,} \quad AS_n = \pi \frac{1}{p} \cdot LE \cdot D_{\min} \left(\frac{1}{2 \frac{1}{p}} + 0.57735(D_{\min} - D_{2\max}) \right)$$

SSn = Shear Stress (psi)
P = Maximum Rated Pressure (psig)
A = Pressurized Area (sq in)
ASn = Minimum Female Thread Shear Area (sq in)
dmax = Maximum Diameter of Pressure Area (in)
Dmin = Minimum Major Diameter of Male Thread (in)
D2max = Maximum Pitch Diameter of Female Thread (in)

4.3.3. Average Shear Stress on the male threads on the end screw that thread into the body is calculated using the standard stress equation, where the thread shear cylinder diameter is calculated using the second equation in section B2 in Appendix B of ANSI B1.1:

$$SS_s = \frac{PA}{AS_s} = \frac{P\left(\frac{\pi}{4}d_{\max}^2\right)}{AS_s} \quad \text{where,} \quad AS_s = \pi \frac{1}{p} \cdot LE \cdot D_{1\max} \left(\frac{1}{2 \frac{1}{p}} + 0.57735(d_{2\min} - D_{1\max}) \right)$$

SSn = Shear Stress (psi)
P = Maximum Rated Pressure (psig)
A = Pressurized Area (sq in)
ASn = Minimum Female Thread Shear Area (sq in)
D1max = Maximum Minor diameter of Female Thread (in)
D2min = Minimum Pitch diameter of Male Thread (in)

4.3.4. The shear stress on the cap ring shoulder was calculated based on the formula below:

$$S_s = \frac{\text{Force}}{\text{Stressed Area}} \quad \text{For force created by internal pressure} \quad S_s = \frac{PD^2}{4dt_{\min}}$$

Where:

P = Maximum Internal Rated Working Pressure
D = Maximum Pressurized Diameter Causing Shear Load
d = Minimum Diameter of Stressed Cross-section
t_{min} = Minimum Thickness of stressed Cross-section

CRN Compliance Summary

K Series Pressure Regulators

Per ASME B31.3, Section 302.3.1(b), the maximum allowable stress in shear is 0.8 times the allowable tensile stress.

The calculated shear stress for all of the pressure regulators was less than the allowable stress for each of the models and raw materials see Appendix D for the calculations.

5.0 MARKING

The Swagelok K Series Pressure Regulators are marked on the exterior of the body with the following information: manufacturer's name (Swagelok), order number, and part number including material designator as noted in MSS SP-25.

6.0 End Connections

The pipe fittings are covered by registration number OA12577.5C. The VCR fittings are covered by registration numbers OA10630.2 and OA12577.5ADD1. The VCR fitting glands are welded to the regulator body in the same manner that the tube stubs are welded. Thread engagement on each of the NPT ports (inlet and outlet) comply with ANSI standard B1.20.1.

7.0 CONCLUSIONS

The summary provided above supports compliance of the Swagelok K Series Pressure Regulators with the requirements of ASME B31.1-2022 "Power Piping" as an unlisted component per Section 104.7.2 and ASME B31.3-2022 "Process Piping" as an unlisted component per Section 304.7.2.

Product Engineers: Stephen Franklin

Date: April 27, 2023

CRN Compliance Summary

K Series Pressure Regulators

Appendix A – Body Hoop Stress Calculations

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | Inlet | | Outlet | | 2*Do / 2*tmin | | Hoop Stress (psi) | | Allowable Stress (psi) |
|--------|-----------------------|--------|------------------|---------------|------|-------|-------|--------|-------|---------------|--------|-------------------|--------|------------------------|
| | Inlet | Outlet | | UNS | ASTM | Do | tmin | Do | tmin | Inlet | Outlet | Inlet | Outlet | |
| KPR | 6000 | 500 | 100 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 14147 | 3246 | 20000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 19356 |
| KPR | 3600 | 500 | 100 | C67500 | B138 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 14667 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 9600 |
| KPR | 3600 | 500 | 100 | N04400 | B164 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 26600 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 23972 |
| KPR | 3600 | 500 | 100 | N10276 | B574 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 27300 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 27300 |
| KCY | 6000 | 500 | 100 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 14147 | 3246 | 20000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 19356 |
| KCY | 3600 | 500 | 100 | C67500 | B138 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 14667 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 9600 |
| KCY | 3600 | 500 | 100 | N04400 | B164 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 26600 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 23972 |
| KCY | 3600 | 500 | 100 | N10276 | B574 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 27300 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 27300 |
| KCM | 3600 | 500 | 100 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 20000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.128 | 5.5 | 13.8 | 8488 | 3246 | 19356 |
| KLF | 3600 | 250 | 100 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 8488 | 5262 | 20000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 8488 | 5262 | 19356 |
| KHF | 3600 | 250 | 100 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 8488 | 5262 | 20000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 8488 | 5262 | 19356 |
| KCP | 3600 | 1500 | 100 | S31600 | A479 | 0.535 | 0.086 | 1.480 | 0.192 | 6.2 | 7.7 | 9789 | 5179 | 20000 |
| | 3600 | 1500 | 392 | S31600 | A479 | 0.535 | 0.086 | 1.480 | 0.192 | 6.2 | 7.7 | 9789 | 5179 | 19356 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | Inlet | | Outlet | | 2*Do / 2*tmin | | Hoop Stress (psi) | | Allowable Stress (psi) |
|--------------------|-----------------------|--------|------------------|---------------|------|-------|-------|--------|-------|---------------|--------|-------------------|--------|------------------------|
| | Inlet | Outlet | | UNS | ASTM | Do | tmin | Do | tmin | Inlet | Outlet | Inlet | Outlet | |
| KPP | 6000 | 3000 | 100 | S31600 | A479 | 1.484 | 0.516 | 1.764 | 0.128 | 2.9 | 13.8 | 7231 | 19477 | 20000 |
| | 6000 | 2975 | 392 | S31600 | A479 | 1.484 | 0.516 | 1.764 | 0.128 | 2.9 | 13.8 | 7231 | 19315 | 19356 |
| KPF | 6000 | 4000 | 100 | S31600 | A479 | 1.945 | 0.602 | 2.676 | 0.494 | 3.2 | 5.4 | 8032 | 9293 | 20000 |
| | 6000 | 4000 | 392 | S31600 | A479 | 1.945 | 0.602 | 2.676 | 0.494 | 3.2 | 5.4 | 8032 | 9293 | 19300 |
| KHP | 10000 | 8000 | 100 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 12802 | 19650 | 20000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 12802 | 19650 | 20000 |
| KHR | 10000 | 8000 | 100 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 12802 | 19650 | 20000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 12802 | 19650 | 20000 |
| KBP | 500 | 500 | 100 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.132 | 5.5 | 13.4 | 1179 | 3143 | 20000 |
| | 500 | 500 | 392 | S31600 | A479 | 0.802 | 0.146 | 1.764 | 0.132 | 5.5 | 13.4 | 1179 | 3143 | 19356 |
| KFB | 250 | 250 | 100 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 589 | 5262 | 20000 |
| | 250 | 250 | 392 | S31600 | A479 | 0.802 | 0.146 | 2.449 | 0.057 | 5.5 | 42.9 | 589 | 5262 | 19356 |
| KCB | 375 | 375 | 100 | S31600 | A479 | 0.535 | 0.086 | 1.480 | 0.192 | 6.2 | 7.7 | 1020 | 1295 | 20000 |
| | 375 | 375 | 392 | S31600 | A479 | 0.535 | 0.086 | 1.480 | 0.192 | 6.2 | 7.7 | 1020 | 1295 | 19356 |
| KPB | 3000 | 3000 | 100 | S31600 | A479 | 1.484 | 0.516 | 1.764 | 0.128 | 2.9 | 13.8 | 3616 | 19477 | 20000 |
| | 2975 | 2975 | 392 | S31600 | A479 | 1.484 | 0.516 | 1.764 | 0.128 | 2.9 | 13.8 | 3585 | 19315 | 19356 |
| KHB | 8000 | 8000 | 100 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 10242 | 19650 | 20000 |
| | 8000 | 8000 | 212 | S31600 | A479 | 1.449 | 0.470 | 2.213 | 0.388 | 3.1 | 5.7 | 10242 | 19650 | 20000 |
| KEV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.287 | 0.461 | 1.764 | 0.128 | 2.8 | 13.8 | 4234 | 3246 | 20000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.287 | 0.461 | 1.764 | 0.128 | 2.8 | 13.8 | 4234 | 3246 | 19356 |
| KEV (piston) | 3600 | 3000 | 100 | S31600 | A479 | 1.287 | 0.461 | 1.764 | 0.128 | 2.8 | 13.8 | 4234 | 19477 | 20000 |
| | 3600 | 2975 | 392 | S31600 | A479 | 1.287 | 0.461 | 1.764 | 0.128 | 2.8 | 13.8 | 4234 | 19315 | 19356 |
| KSV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.318 | 0.451 | 1.764 | 0.128 | 2.9 | 13.8 | 4394 | 3246 | 20000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.318 | 0.451 | 1.764 | 0.128 | 2.9 | 13.8 | 4394 | 3246 | 19356 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix B – Cap Ring Thread Shear Stress on Female Threads

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | D _{2max} | D _{min} | d _{max} | LE | 1/p | ASs | SSs | ALLSS |
|--------|-----------------------|--------|------------------|---------------|------|-------------------|------------------|------------------|-------|-------|-------|-----|-------|
| | Inlet | Outlet | | UNS | ASTM | | | | | | | | |
| KPR | 6000 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 15485 |
| KPR | 3600 | 500 | 100 | C67500 | B138 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 7680 |
| KPR | 3600 | 500 | 100 | N04400 | B164 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 19178 |
| KPR | 3600 | 500 | 100 | N10276 | B574 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21840 |
| KCY | 6000 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 15485 |
| KCY | 3600 | 500 | 100 | C67500 | B138 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 7680 |
| KCY | 3600 | 500 | 100 | N04400 | B164 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 19178 |
| KCY | 3600 | 500 | 100 | N10276 | B574 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 21840 |
| KCM | 3600 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 15485 |
| KLF | 3600 | 250 | 100 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 15485 |
| KHF | 3600 | 250 | 100 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 15485 |
| KCP | 3600 | 1500 | 100 | S31600 | A479 | 1.3452 | 1.3648 | 0.4339 | 0.197 | 18.00 | 0.594 | 373 | 16000 |
| | 3600 | 1500 | 392 | S31600 | A479 | 1.3452 | 1.3648 | 0.4339 | 0.197 | 18.00 | 0.594 | 373 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | D _{2max} | D _{min} | d _{max} | LE | 1/p | ASs | SSs | ALLSS |
|--------------------|-----------------------|--------|------------------|---------------|------|-------------------|------------------|------------------|-------|-------|-------|------|-------|
| | Inlet | Outlet | | UNS | ASTM | | | | | | | | |
| KPP | 6000 | 3000 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3807 | 16000 |
| | 6000 | 2975 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3776 | 15485 |
| KPF | 6000 | 4000 | 100 | S31600 | A479 | 2.6472 | 2.6665 | 2.0472 | 0.354 | 16.93 | 2.046 | 6435 | 16000 |
| | 6000 | 4000 | 392 | S31600 | A479 | 2.6472 | 2.6665 | 2.0472 | 0.354 | 16.93 | 2.046 | 6435 | 15485 |
| KHP | 10000 | 8000 | 100 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| KHR | 10000 | 8000 | 100 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| KBP | 500 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 16000 |
| | 500 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.315 | 18.00 | 1.357 | 658 | 15485 |
| KFB | 250 | 250 | 100 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 16000 |
| | 250 | 250 | 392 | S31600 | A479 | 2.6472 | 2.6665 | 2.3346 | 0.354 | 16.93 | 2.046 | 523 | 15485 |
| KCB | 375 | 375 | 100 | S31600 | A479 | 1.3452 | 1.3648 | 0.4339 | 0.197 | 18.00 | 0.594 | 93 | 16000 |
| | 375 | 375 | 392 | S31600 | A479 | 1.3452 | 1.3648 | 0.4339 | 0.197 | 18.00 | 0.594 | 93 | 15485 |
| KPB | 3000 | 3000 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3807 | 16000 |
| | 2975 | 2975 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3776 | 15485 |
| KHB | 8000 | 8000 | 100 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| | 8000 | 8000 | 212 | S31600 | A479 | 1.8598 | 1.8791 | 1.4134 | 0.902 | 16.93 | 3.669 | 3421 | 16000 |
| KEV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 635 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 635 | 15485 |
| KEV (piston) | 3600 | 3000 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3807 | 16000 |
| | 3600 | 2975 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 3776 | 15485 |
| KSV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 635 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8413 | 1.8640 | 1.5079 | 0.339 | 16.00 | 1.407 | 635 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix B – Body Thread Shear Stress on Male Threads

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | D _{1max} | d _{2min} | d _{max} | LE | 1/p | AS _s | SS _s | ALLSS |
|--------|-----------------------|--------|------------------|---------------|------|-------------------|-------------------|------------------|-------|------|-----------------|-----------------|-------|
| | Inlet | Outlet | | UNS | ASTM | | | | | | | | |
| KPR | 6000 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 15485 |
| KPR | 3600 | 500 | 100 | C67500 | B138 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 7680 |
| KPR | 3600 | 500 | 100 | N04400 | B164 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 19178 |
| KPR | 3600 | 500 | 100 | N10276 | B574 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21840 |
| KCY | 6000 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 15485 |
| KCY | 6000 | 500 | 100 | C67500 | B138 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 7680 |
| KCY | 6000 | 500 | 100 | N04400 | B164 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 19178 |
| KCY | 6000 | 500 | 100 | N10276 | B574 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 21840 |
| KCM | 3600 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 15485 |
| KLF | 3600 | 250 | 100 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 15485 |
| KHF | 3600 | 250 | 100 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 15485 |
| KCP | 3600 | 1500 | 100 | S31600 | A479 | 1.3280 | 1.3325 | 0.4339 | 0.197 | 18.0 | 0.449 | 494 | 16000 |
| | 3600 | 1500 | 392 | S31600 | A479 | 1.3280 | 1.3325 | 0.4339 | 0.197 | 18.0 | 0.449 | 494 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | | | | | | | | |
|--------------------|-----------------------|--------|------------------|---------------|------|-------------------|-------------------|------------------|-------|------|-----------------|-----------------|-------|
| | Inlet | Outlet | | UNS | ASTM | D _{1max} | d _{2min} | d _{max} | LE | 1/p | AS _s | SS _s | ALLSS |
| KPP | 6000 | 3000 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4939 | 16000 |
| | 6000 | 2975 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4897 | 15485 |
| KPF | 6000 | 4000 | 100 | S31600 | A479 | 2.6250 | 2.6311 | 2.0472 | 0.354 | 16.9 | 1.634 | 8057 | 16000 |
| | 6000 | 4000 | 392 | S31600 | A479 | 2.6250 | 2.6311 | 2.0472 | 0.354 | 16.9 | 1.634 | 8057 | 15485 |
| KHP | 10000 | 8000 | 100 | S31600 | A479 | 1.8376 | 1.8500 | 1.413 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.8376 | 1.8500 | 1.413 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| KHR | 10000 | 8000 | 100 | S31600 | A479 | 1.8376 | 1.8500 | 1.4134 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 1.8376 | 1.8500 | 1.4134 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| KBP | 500 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 16000 |
| | 500 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.315 | 18.0 | 1.023 | 873 | 15485 |
| KFB | 250 | 250 | 100 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 16000 |
| | 250 | 250 | 392 | S31600 | A479 | 2.6250 | 2.6311 | 2.3346 | 0.354 | 16.9 | 1.634 | 655 | 15485 |
| KCB | 375 | 375 | 100 | S31600 | A479 | 1.3280 | 1.3325 | 0.4339 | 0.197 | 18.0 | 0.449 | 123 | 16000 |
| | 375 | 375 | 392 | S31600 | A479 | 1.3280 | 1.3325 | 0.4339 | 0.197 | 18.0 | 0.449 | 123 | 15485 |
| KPB | 3000 | 3000 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4939 | 16000 |
| | 2975 | 2975 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4897 | 15485 |
| KHB | 8000 | 8000 | 100 | S31600 | A479 | 1.8376 | 1.8500 | 1.4134 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| | 8000 | 8000 | 212 | S31600 | A479 | 1.8376 | 1.8500 | 1.4134 | 0.902 | 16.9 | 3.231 | 3884 | 16000 |
| KEV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 165 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 645 | 15485 |
| KEV (piston) | 3600 | 3000 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4939 | 16000 |
| | 3600 | 2975 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 4897 | 15485 |
| KSV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 823 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 1.8210 | 1.8275 | 1.5079 | 0.339 | 16.0 | 1.085 | 823 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix C – Body Thread Shear Stress on Female Threads

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | D _{2max} | D _{min} | d _{max} | LE | 1/p | ASs | SSs | ALLSS |
|--------|-----------------------|--------|------------------|---------------|------|-------------------|------------------|------------------|-------|-----|-------|------|-------|
| | Inlet | Outlet | | UNS | ASTM | | | | | | | | |
| KPR | 6000 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 4875 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 15485 |
| KPR | 3600 | 500 | 100 | C67500 | B138 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 7680 |
| KPR | 3600 | 500 | 100 | N04400 | B164 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 19178 |
| KPR | 3600 | 500 | 100 | N10276 | B574 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21840 |
| KCY | 6000 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 4875 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 15485 |
| KCY | 3600 | 500 | 100 | C67500 | B138 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 7680 |
| KCY | 3600 | 500 | 100 | N04400 | B164 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 19178 |
| KCY | 3600 | 500 | 100 | N10276 | B574 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 21480 |
| KCM | 3600 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 15485 |
| KLF | 3600 | 250 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2925 | 15485 |
| KHF | 3600 | 250 | 100 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 3381 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 3381 | 15485 |
| KCP | 3600 | 1500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 1991 | 16000 |
| | 3600 | 1500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 1991 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | | | | | | | | |
|--------------------|-----------------------|--------|------------------|---------------|------|-------------------|------------------|------------------|-------|-----|-------|------|-------|
| | Inlet | Outlet | | UNS | ASTM | D _{2max} | D _{min} | d _{max} | LE | 1/p | ASs | SSs | ALLSS |
| KPP | 6000 | 3000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2438 | 16000 |
| | 6000 | 2975 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2417 | 15485 |
| KPF | 6000 | 4000 | 100 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 3757 | 16000 |
| | 6000 | 4000 | 392 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 3757 | 15485 |
| KHP | 10000 | 8000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| KHR | 10000 | 8000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| KBP | 500 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.076 | 20 | 0.093 | 433 | 16000 |
| | 500 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.076 | 20 | 0.093 | 433 | 15485 |
| KFB | 250 | 250 | 100 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 235 | 16000 |
| | 250 | 250 | 392 | S31600 | A479 | 0.8568 | 0.8656 | 0.5630 | 0.162 | 20 | 0.265 | 235 | 15485 |
| KCB | 375 | 375 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.076 | 20 | 0.093 | 325 | 16000 |
| | 375 | 375 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.076 | 20 | 0.093 | 325 | 15485 |
| KPB | 3000 | 3000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2438 | 16000 |
| | 2975 | 2975 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 2417 | 15485 |
| KHB | 8000 | 8000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| | 8000 | 8000 | 212 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 6501 | 16000 |
| KEV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 277 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 277 | 15485 |
| KEV (piston) | 3600 | 3000 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 1659 | 16000 |
| | 3600 | 2975 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.119 | 20 | 0.145 | 1645 | 15485 |
| KSV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 406 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5355 | 0.5531 | 0.3200 | 0.081 | 20 | 0.099 | 406 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix C – Seat Retainer Thread Shear Stress on Male Threads

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | D _{1max} | d _{2min} | d _{max} | LE | 1/p | AS _s | SS _s | ALLSS |
|--------|-----------------------|--------|------------------|---------------|------|-------------------|-------------------|------------------|-------|-----|-----------------|-----------------|-------|
| | Inlet | Outlet | | UNS | ASTM | | | | | | | | |
| KPR | 6000 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 15485 |
| KPR | 3600 | 500 | 100 | C67500 | B138 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 7680 |
| KPR | 3600 | 500 | 100 | N04400 | B164 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 19178 |
| KPR | 3600 | 500 | 100 | N10276 | B574 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 21840 |
| KCY | 6000 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 15485 |
| KCY | 6000 | 500 | 100 | C67500 | B138 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 11733 |
| | 3600 | 500 | 392 | C67500 | B138 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 7680 |
| KCY | 6000 | 500 | 100 | N04400 | B164 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 21280 |
| | 3600 | 500 | 392 | N04400 | B164 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 19178 |
| KCY | 6000 | 500 | 100 | N10276 | B574 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 21840 |
| | 3600 | 500 | 392 | N10276 | B574 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 21840 |
| KCM | 3600 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 15485 |
| KLF | 3600 | 250 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 15485 |
| KHF | 3600 | 250 | 100 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 3811 | 16000 |
| | 3600 | 250 | 392 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 3811 | 15485 |
| KCP | 3600 | 1500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 16000 |
| | 3600 | 1500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | Pressure Rating (psi) | | Temp. Rating (F) | Body Material | | | | | LE | 1/p | AS _s | SS _s | ALLSS |
|--------------------|-----------------------|--------|------------------|---------------|------|-------------------|-------------------|------------------|-------|-----|-----------------|-----------------|-------|
| | Inlet | Outlet | | UNS | ASTM | D _{1max} | d _{2min} | d _{max} | | | | | |
| KPP | 6000 | 3000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 16000 |
| | 6000 | 2975 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 6607 | 15485 |
| KPF | 6000 | 4000 | 100 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 6351 | 16000 |
| | 6000 | 4000 | 392 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 6351 | 15485 |
| KHP | 10000 | 8000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 11011 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 11011 | 16000 |
| KHR | 10000 | 8000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 11011 | 16000 |
| | 10000 | 8000 | 212 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 11011 | 16000 |
| KBP | 500 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.076 | 20 | 0.069 | 587 | 16000 |
| | 500 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.076 | 20 | 0.069 | 587 | 15485 |
| KFB | 250 | 250 | 100 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 265 | 16000 |
| | 250 | 250 | 392 | S31600 | A479 | 0.8320 | 0.8368 | 0.5630 | 0.162 | 20 | 0.235 | 265 | 15485 |
| KCB | 375 | 375 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.076 | 20 | 0.069 | 440 | 16000 |
| | 375 | 375 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.076 | 20 | 0.069 | 440 | 15485 |
| KPB | 3000 | 3000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3303 | 16000 |
| | 2975 | 2975 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3276 | 15485 |
| KHB | 8000 | 8000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 8809 | 16000 |
| | 8000 | 8000 | 212 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 8809 | 16000 |
| KEV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 15485 |
| KEV (piston) | 3600 | 3000 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 16000 |
| | 3600 | 2975 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.119 | 20 | 0.107 | 2698 | 15485 |
| KSV (diaphragm) | 3600 | 500 | 100 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 16000 |
| | 3600 | 500 | 392 | S31600 | A479 | 0.5200 | 0.5245 | 0.3200 | 0.081 | 20 | 0.073 | 3964 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix D – Cap Ring Shear Stress on Retaining Shoulder

| Series | P (psi) | Temp. Rating (F) | Body Material | | D | d | t _{min} | Shear Stress (psi) | Allowable Stress (psi) |
|--------|---------|------------------------|---------------|------|-------|-------|------------------|-----------------------|---------------------------|
| | (psi) | | UNS | ASTM | (in) | (in) | (in) | | |
| KPR | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |
| KPR | 500 | 100 | C67500 | B138 | 1.508 | 1.722 | 0.166 | 994 | 11733 |
| | 500 | 392 | C67500 | B138 | 1.508 | 1.722 | 0.166 | 994 | 7680 |
| KPR | 500 | 100 | N04400 | B164 | 1.508 | 1.722 | 0.166 | 994 | 21280 |
| | 500 | 392 | N04400 | B164 | 1.508 | 1.722 | 0.166 | 994 | 19178 |
| KPR | 500 | 100 | N10276 | B574 | 1.508 | 1.722 | 0.166 | 994 | 21840 |
| | 500 | 392 | N10276 | B574 | 1.508 | 1.722 | 0.166 | 994 | 21840 |
| KCY | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |
| KCY | 500 | 100 | C67500 | B138 | 1.508 | 1.722 | 0.166 | 994 | 11733 |
| | 500 | 392 | C67500 | B138 | 1.508 | 1.722 | 0.166 | 994 | 7680 |
| KCY | 500 | 100 | N04400 | B164 | 1.508 | 1.722 | 0.166 | 994 | 21280 |
| | 500 | 392 | N04400 | B164 | 1.508 | 1.722 | 0.166 | 994 | 19178 |
| KCY | 500 | 100 | N10276 | B574 | 1.508 | 1.722 | 0.166 | 994 | 21840 |
| | 500 | 392 | N10276 | B574 | 1.508 | 1.722 | 0.166 | 994 | 21840 |
| KCM | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |
| KLF | 250 | 100 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 16000 |
| | 250 | 392 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 15485 |
| KHF | 250 | 100 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 16000 |
| | 250 | 392 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 15485 |
| KCP | 1500 | 100 | S31600 | A479 | 1.097 | 1.032 | 0.224 | 1950 | 16000 |
| | 1500 | 392 | S31600 | A479 | 1.097 | 1.032 | 0.224 | 1950 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

| Series | P (psi) | Temp. Rating (F) | Body Material | | D (in) | d (in) | t _{min} (in) | Shear Stress (psi) | Allowable Stress (psi) |
|--------------------|---------|------------------|---------------|------|--------|--------|-----------------------|--------------------|------------------------|
| | (psi) | (F) | UNS | ASTM | (in) | (in) | (in) | (psi) | (psi) |
| KPP | 3000 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5967 | 16000 |
| | 2975 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5917 | 15485 |
| KPF | 4000 | 100 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 9534 | 16000 |
| | 4000 | 392 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 9534 | 15440 |
| KHP | 8000 | 100 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| | 8000 | 212 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| KHR | 8000 | 100 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| | 8000 | 212 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| KBP | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |
| KFB | 250 | 100 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 16000 |
| | 250 | 392 | S31600 | A479 | 2.335 | 2.587 | 0.221 | 596 | 15485 |
| KCB | 375 | 100 | S31600 | A479 | 1.097 | 1.032 | 0.224 | 488 | 16000 |
| | 375 | 392 | S31600 | A479 | 1.097 | 1.032 | 0.224 | 488 | 15485 |
| KPB | 3000 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5967 | 16000 |
| | 2975 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5917 | 15485 |
| KHB | 8000 | 100 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| | 8000 | 212 | S31600 | A479 | 1.315 | 1.591 | 0.449 | 4841 | 16000 |
| KEV (diaphragm) | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |
| KEV (piston) | 3000 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5967 | 16000 |
| | 2975 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 5917 | 15485 |
| KSV (diaphragm) | 500 | 100 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 16000 |
| | 500 | 392 | S31600 | A479 | 1.508 | 1.722 | 0.166 | 994 | 15485 |

CRN Compliance Summary

K Series Pressure Regulators

Appendix E



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TEST REPORT — EAR-CONTROLLED DATA

Date: 5/24/2013
P.O. No.: K57264
W/O No.: CRA002-13-05-77291-1
Date Received: 5/21/2013

Sample Description: One (1) 2" Dia. Bar x 20" Lg., ASTM E21-05, P/N: B2A-05080

Elevated Temp Tensile

| | |
|-------------|----------|
| Test Method | ASTM E21 |
|-------------|----------|

| Specimen | Initial Diameter (in) | 0.2% Offset Yield Strength (ksi) | Ultimate Tensile Strength (ksi) | Elongation in 4D (%) | Reduction of Area (%) | Test Temp (°C) |
|----------|-----------------------|----------------------------------|---------------------------------|----------------------|-----------------------|----------------|
| Results | .2490 | 41 | 70 | 42 | 47.5 | 100 |

Elevated Temp Tensile

| | |
|-------------|----------|
| Test Method | ASTM E21 |
|-------------|----------|

| Specimen | Initial Diameter (in) | 0.2% Offset Yield Strength (ksi) | Ultimate Tensile Strength (ksi) | Elongation in 4D (%) | Reduction of Area (%) | Test Temp (°C) |
|----------|-----------------------|----------------------------------|---------------------------------|----------------------|-----------------------|----------------|
| Results | .2495 | 41 | 54 | 52.5 | 66.5 | 200 |

Room Temp Tensile

| | |
|-------------|----------------------|
| Test Method | ASTM A 370, ASTM E 8 |
|-------------|----------------------|

| Specimen | Initial Diameter (in) | 0.2% Offset Yield Strength (ksi) | Ultimate Tensile Strength (ksi) | Elongation in 4D (%) | Reduction of Area (%) |
|----------|-----------------------|----------------------------------|---------------------------------|----------------------|-----------------------|
| Results | .5037 | 41.5 | 82.5 | 30.5 | 35 |

10CFR21 and 10CFR50 Appendix B apply to this order.

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Lisa Ward
Quality Administrator