Kana Energy Services, Inc.

Installation Manual

Surge and Pulsation Control

Kana-Series Dampeners

Manual 6050-A

INSTALLATION, OPERATION, MAINTENANCE AND PARTS

Installation Manual

Surge and Pulsation Control Kana-Series

PREFACE

KANA makes no warranties of any kind, expressed or implied, including any warranty of mechanical fitness for any particular purpose that the work performed pursuant to this manual will be free from defects in workmanship or material.

KANA retains for itself all propriety rights in and to all designs, engineering details, data, and procedures set forth herein. This manual is intended for the sole use of KANA customers, and they shall strictly control copying of same, as this manual and all copies thereof may be recalled by KANA at any time.

This manual makes recommendations only. The customer is at all times responsible for actual disassembly, inspection, reassembly, and testing of the pulsation dampener vessel. The customer also is solely responsible for providing competent and qualified persons; equipment and facilities to perform such operations; and for workman- ship and safety. If at any time the customer is unable to understand recommendations made in this manual or is unable to follow those recommendations, they should consult the nearest KANA location. Refer to KANA website http://www.kanaenergy.com/ for complete list of locations, including addresses, telephone numbers, and FAX numbers.

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Please contact KANA Pressure Control Equipment for any assistance or questions concerning the information in this manual. All information contained in this manual is the exclusive property of KANA.

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Surge and Pulsation Control Kana-Series

1.0 INSTALLATION

CAUTION: **Do not attempt to pre-charge any Kana-Series pulsation dampener prior to mounting the unit into the pump piping system.**

The KANA Series Pulsation Dampener/Surge Stabilizer should be mounted in the vertical position (refer to Figure 1-3 and 1-4 for mounting options) with the mating flange connection at the bottom. The discharge dampener should be mounted as close as possible to the discharge port of the pump. If possible, it is advantageous that the dampener be mounted in such a way that the fluid stream is directed to- wards the fluid opening (see Figures 1-3 and 1-4) for maxi- mum performance.

1.1 Mounting

1.1.1 Install stud bolts in the replaceable bottom plate.

1.1.2 Position dampener on gasket and mating flange so that the space between flange and bottom connection is totally equal around the circumference.

1.1.3 Install one lubricated nut on each stud and tighten one turn at a time until dampener is firmly in place. Assure that space between dampener and flange is equal.

1.1.4 Cross tighten nuts to the proper torque. Refer to bolting data in Section 3.2.

1.2 Precharging (NITROGEN ONLY)

The correct pre-charge is vital for maximizing efficiency of the pulsation dampener. Generally, pre-charge pressure is based on the average operating pressure of the system, but

Pre-charge can be affected by other system parameters; for example. The use of MWD tools. For these applications, consult qualified KANA personnel for correct pre-charging instructions.

WARNING: ALWAYS PRECHARGE WITH ZERO PRESSURE ON THE SYSTEM AND ALWAYS PRECHARGE WITH **NITROGEN**.

1.3 General Pre-charging Instructions

1.3.1 The charging valve and pressure gauge are located under the valve guard and are exposed by removing the valve guard.

1.3.2 Before pre-charging the dampener, make sure all cover stud nuts are tightened evenly and charging valve and pressure gauge seal nuts are firmly seated on the dampener.

1.3.3 Pre-charging is accomplished by connecting one end of the charging hose assembly to a standard commercially available **NITROGEN** bottle and the other end to the charging valve located at the top of the pulsation dampener (Refer to Figure 1-1).

1.3.4 Pre-charge from a standard commercially available nitrogen bottle **equipped with a pressure regulator**.

1.3.5 For those applications where higher pre-charge pressures are required, a gas booster pump is available; for example, Haskell International Inc.

1.3.6 Open bottle regulator valve until recommended pre-charge pressure shows on regulator gauge.

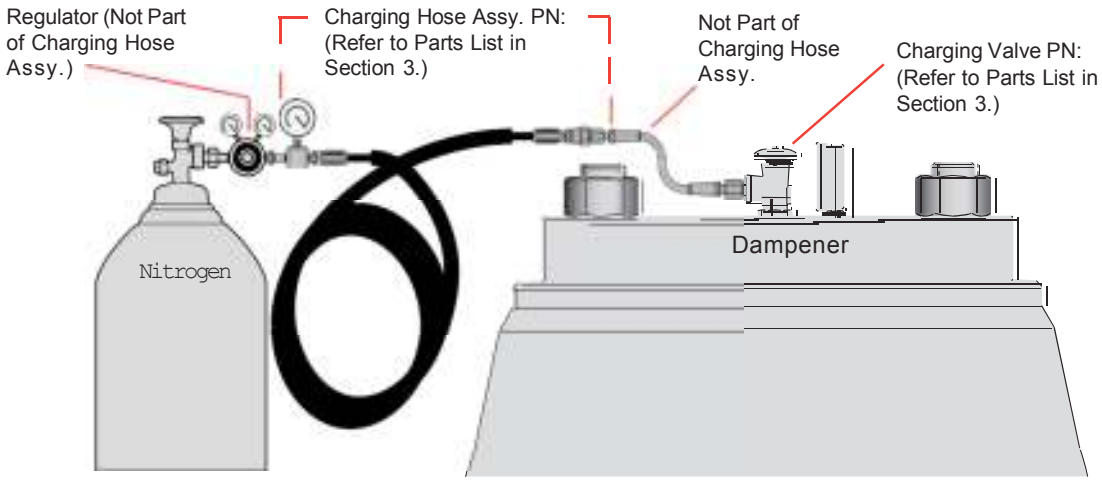

Figure 1-1. Pre-charging Kana Series Dampener

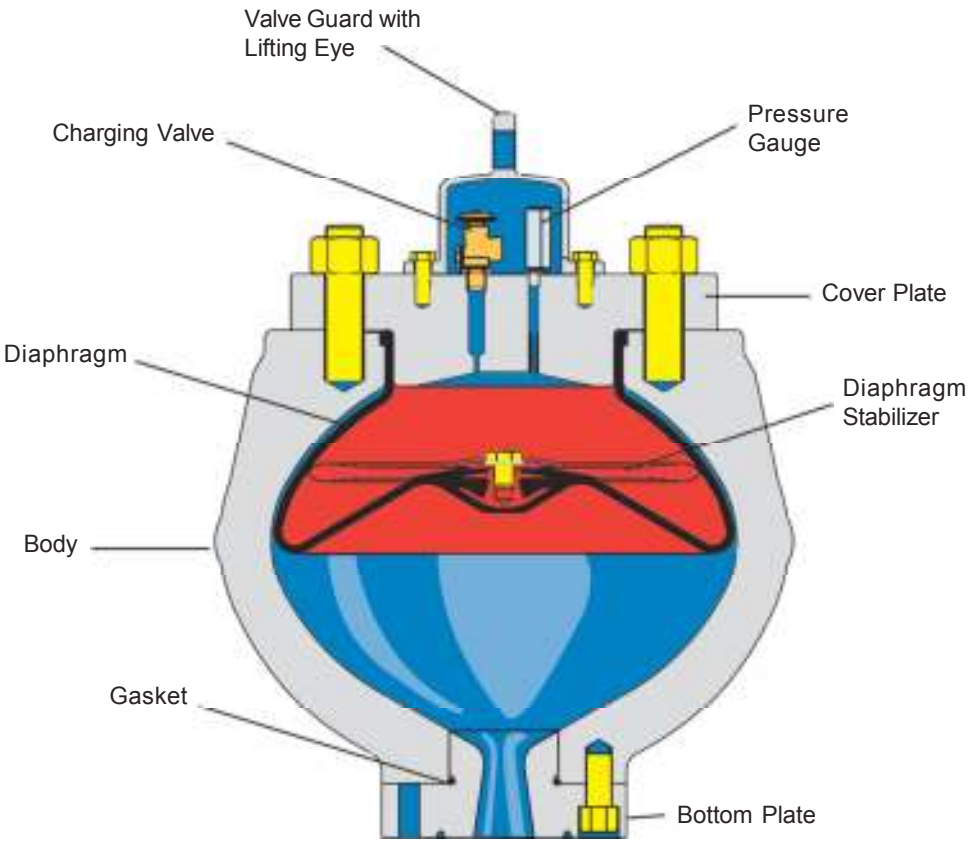

Figure 1-2. Typical Kana Series Pulsation Dampener

1.3.7. Slowly open charging valve on dampener. Allow pressure to increase in the dampener until dampener pressure gauge reads the specified pressure. This process will normally take 5 to 15 minutes. Dampener gauge and regulator gauge should read the same and be equal to the specified pre-charge pressure.

1.3.8. Close the charging valve and tighten. Then, close regulator valve at nitrogen bottle. Remove charging hose, replace dust plug in charging valve, and replace valve guard.

1.4 Pre-charge Recommendations

For normal operating conditions, set the pre-charge pressure at 50 to 70 percent of the average operating discharge pressure not to exceed 5000 PSI. The pre-charge pressure can be as low as 30 percent or as high as 75 percent of system operating pressure. However, these pre-charge settings may shorten diaphragm life.

1.5 Leak Detection

Apply leak detection fluid at all connections around valve, pressure gauge, cover, body contact surfaces, and studs. Observe carefully for bubbles that indicate leaks. If any indications are found, check system for loose connections and retighten. Allow the nitrogen gas in the dampener to come to ambient conditions (approximately one-half hour) and recheck the pre-charge pressure.

Adjust the pre-charge pressure as required. After pre-charge pressure has stabilized at specified pressure, close valves, remove charging hose, and replace valve guard. Dampener is now ready for operation.

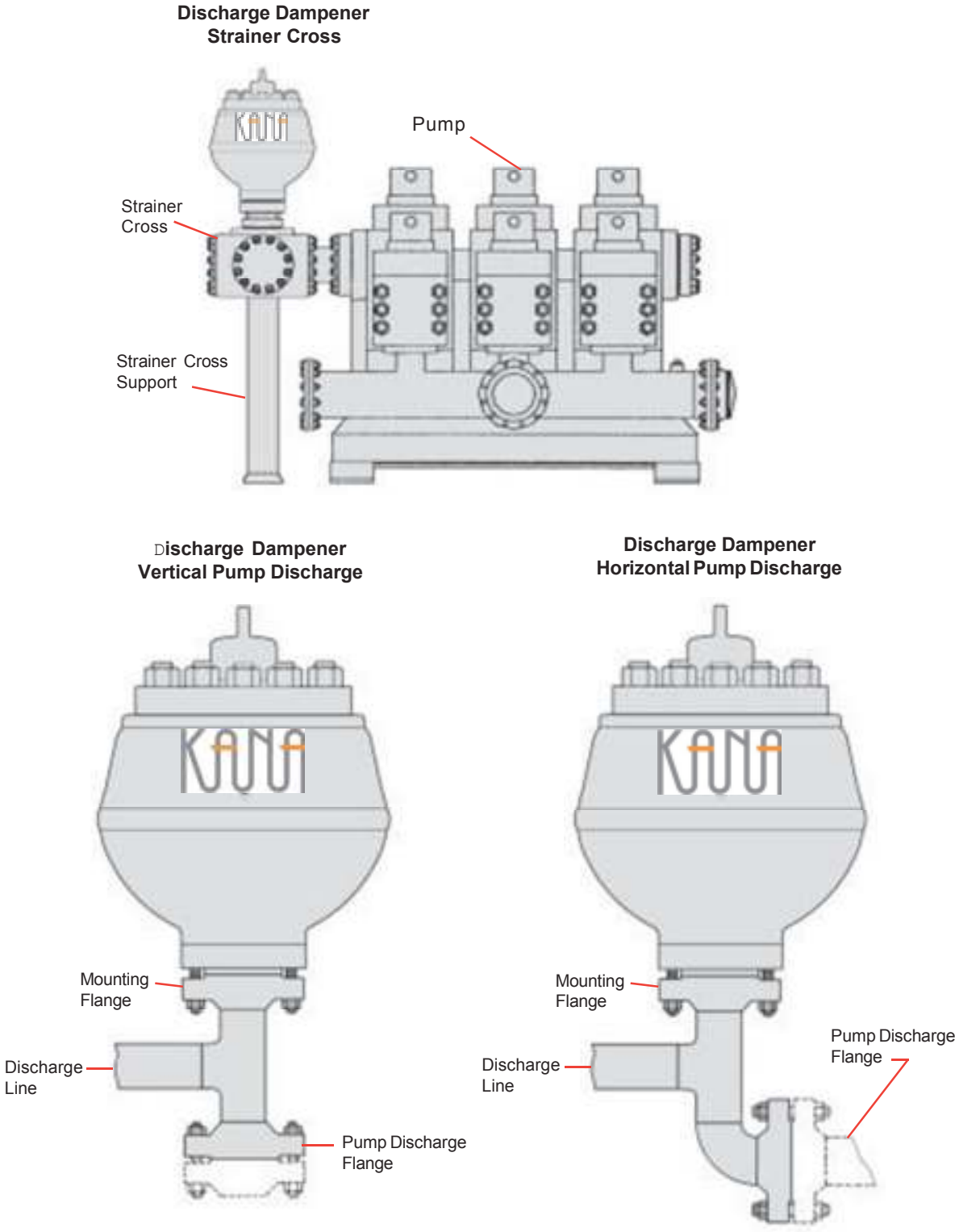

Figure 1-3. Recommended Installation Piping, Kana-Series Discharge Dampeners

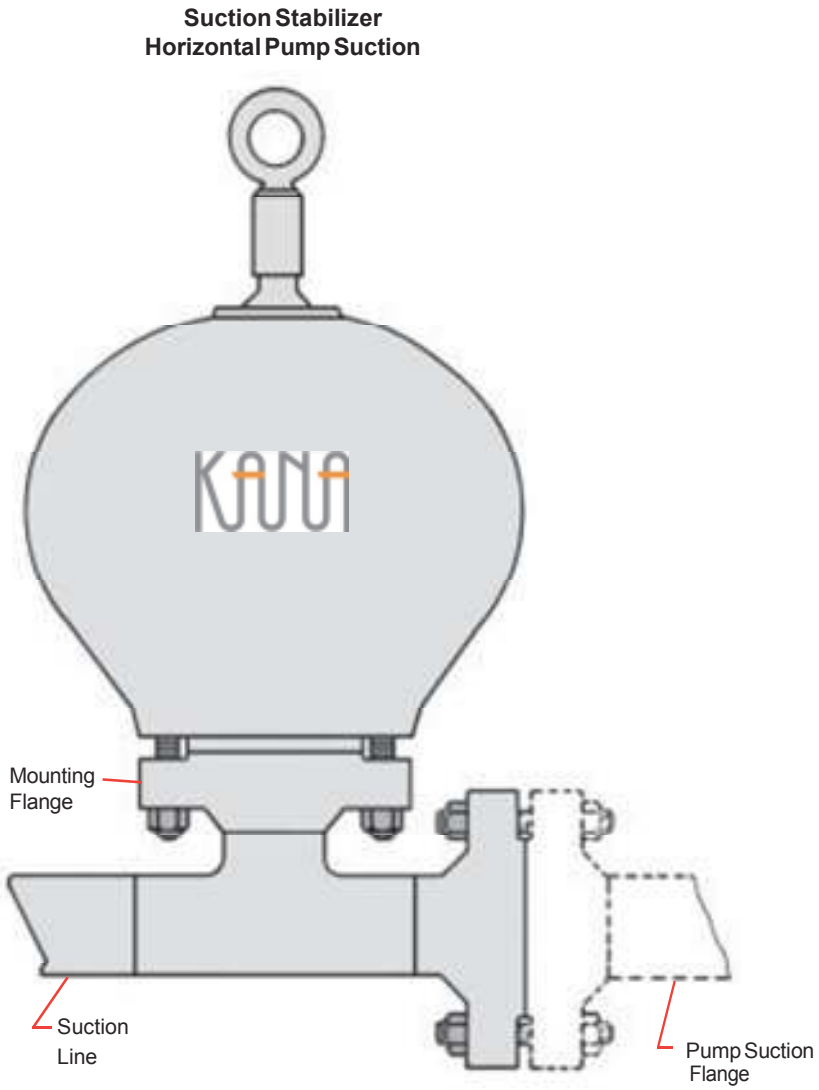

Figure 1-4 Recommended Installation Piping, for Suction Stabilizer - IP Series, Model SS-20-275 (Typical)

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2.0 MAINTENANCE

2.1. Disassembly Procedure

Refer to Figures 2-1 and 2-2.

2.1.1. Shut down pumps and remove system pressure from dampener.

2.1.2. Remove valve guard.

2.1.3. Open charging valve and bleed off all pre-charge pressure. **CAUTION:** System and vessel pressure must be at zero PSI before removing charging valve and pressure gauge or loosening cover or flange bolts.

2.1.4. Remove charging valve and gauge from cover.

2.1.5. Check for system fluid in gauge and valve ports.

2.1.6. Loosen all cover hex nuts, but do not remove. Make sure the cover plate is not pushing upwards against nuts. This would indicate that pressure has not been completely removed from dampener.

2.1.7. After all pressure is removed from dampener, remove nuts from studs.

2.1.8. Attach valve guard to cover plate to use as a lifting eye.

2.1.9. Remove cover.

2.1.10. If dampener is equipped with a stabilizer, remove cap screw, lock washer and stabilizer plate. Remove stabilizer so the diaphragm can be folded and removed from the body.

2.1.11. Pull neck portion of diaphragm loose from one side of dampener. Push bottom of diaphragm down and fold diaphragm. **NOTE**: Place bar between dampener body and diaphragm below the diaphragm mid-section to assist folding and removal of diaphragm from body.

2.1.12. If the bottom plate is to be removed for replacement or inspection, follow the procedure below:

a. Verify cover is attached and all hex nuts are snug.

b. Attach valve guard to cover to use as lifting eye.

c. Remove all flange and hex nuts at bottom connection.

d. Remove dampener from flange connection. Set hex nuts and gaskets aside and save for reinstallation.

e. Remove dirt and debris from bottom plate opening.

f. Remove socket head cap screws that hold bottom plate in place. Set aside and save.

g. Remove bottom plate from dampener. Remove gasket and inspect for damage. Set aside and save if reusable. Replace if damaged.

h. Inspect bottom plate for excessive pitting, corrosion or wear. If these conditions exist, consult your nearest KANA representative for corrective action.

2.2. Cleaning and Inspection Procedure

2.2.1. Flush diaphragm body. Clean and remove scale and other foreign material.

2.2.2. Inspect inside of dampener body for excessive pitting, corrosion, or wear. If these conditions exist, consult your nearest KANA representative.

2.2.3. Mild pitting or scaling can be removed with application of light duty emery cloth. Inside of dampener must be free of burrs and debris.

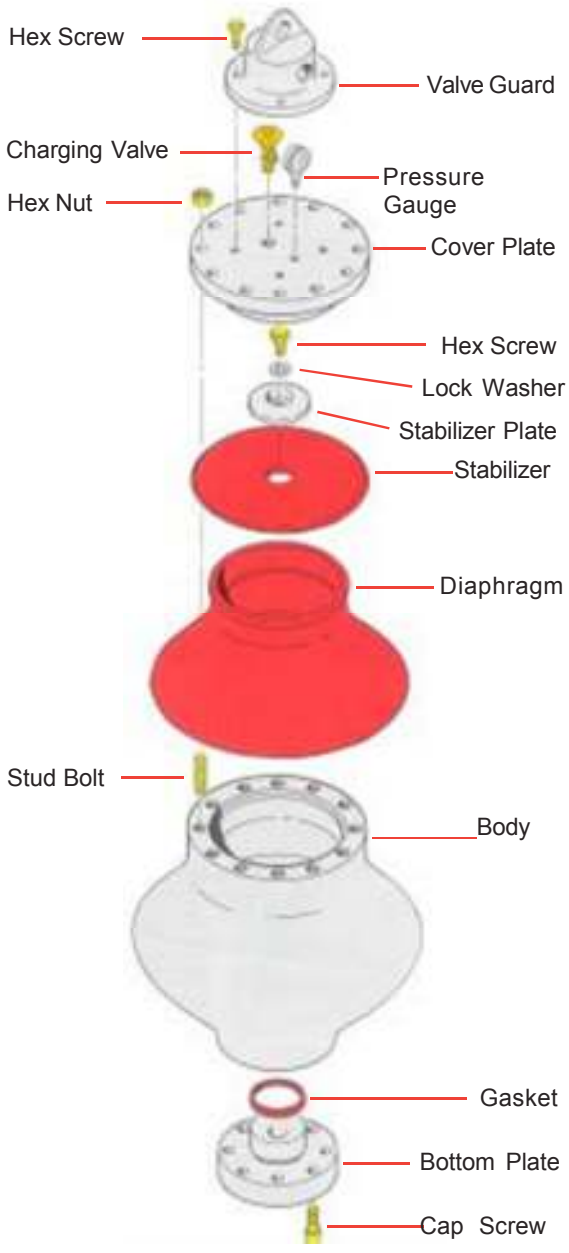

Figure 2-1

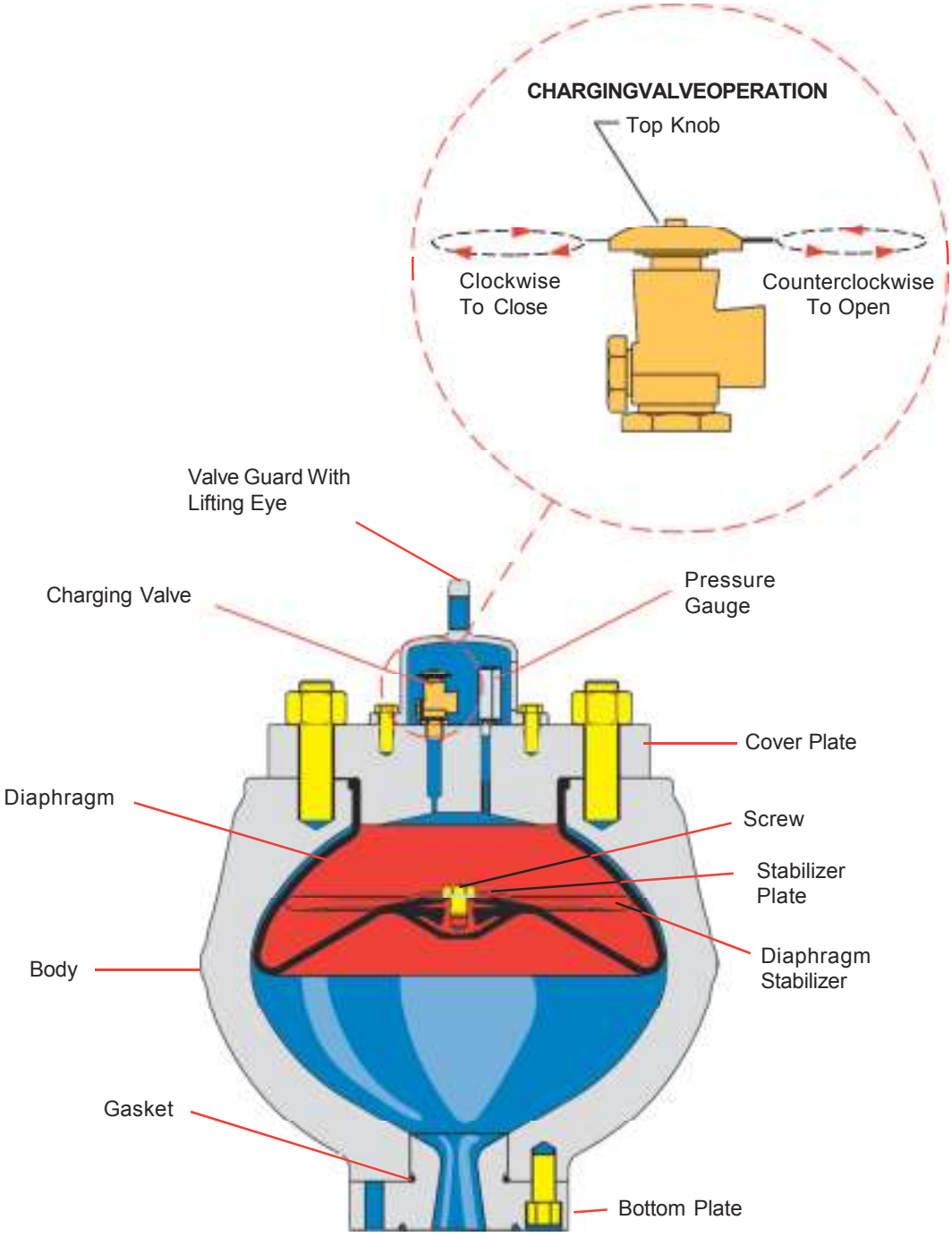

Figure 2-2. Typical Kana-Series Pulsation Dampener - Disassembly

2.3 Assembly Procedure

All metal surfaces of the cover plate, body, and bottom plate which come into contact with the diaphragm must be cleaned carefully before reassembly. Scrape and wire brush all surfaces and completely remove any foreign matter, rust or scale. Refer to Figure 2-3 while following the procedure below.

2.3.1 Place bottom plate gasket in groove of bottom plate.

2.3.2. Insert bottom plate into body taking care not to pinch gasket and align counter bore holes with tapped holes in body. Install socket head cap screws and tighten evenly until bottom plate is snug against body. Torque cap screws (refer to bolting data in Section 3.2 for torque).

2.3.3. Apply a light coat of a general lubricant (castor oil or equivalent) on diaphragm to aid in installation.

2.3.4. Pull up on neck of diaphragm while pushing diaphragm insert area down.

2.3.5. Take the new diaphragm in the *at rest* position and roll one side toward the other forming a crude football shape. A thin belt or strap may be helpful in holding this shape.

2.3.6. Apply lubricant to the folded diaphragm and insert it long ways into the body of the dampener as far as possible (the diaphragm should go over half way into the dampener body).

2.3.7. Fold the remainder of the diaphragm into the vessel and allow it to open inside the body.

2.3.8. Position the diaphragm within the neck of the vessel.

2.3.9. When stabilizer is used, temporarily install hex screw into insert.

2.3.10. Break vacuum at neck by pulling diaphragm slightly away from sealing area.

2.3.11. Pull up on hex nut so diaphragm bottom moves up near neck opening.

2.3.12. Re-seat diaphragm neck, remove hex screw, and install stabilizer.

2.3.13. Fold stabilizer with edge down and insert into diaphragm opening.

2.3.14. Assemble stabilizer plate, lock washer, and hex screw through stabilizer and fasten to diaphragm by attaching hex screw to threaded insert.

2.3.15. Tighten securely with socket wrench.

NOTE: Make certain that the neck portion of the diaphragm and cover plate is clean and free of any debris, rust, or scale. Coat with a light lubricant prior to installation of cover plate to the body.

2.3.16. Install cover plate, studs, and lubricated nuts. Cross tighten by hand or wrench, a few turns at a time, until cover is firmly seated on the dampener body. Cross tighten to the appropriate torque (refer to bolting data in Section 3.2 for torque).

2.3.17. Unscrew lock nut on valve and thread valve into tapped hole. Tighten to 20 ± 5 lb-ft or 27 ± 7 N•m torque.

2.3.18. If the valve is not facing in the proper direction, take the following steps:

a. Rotate forward if ***less*** than a ½ turn is required to position valve in proper direction.

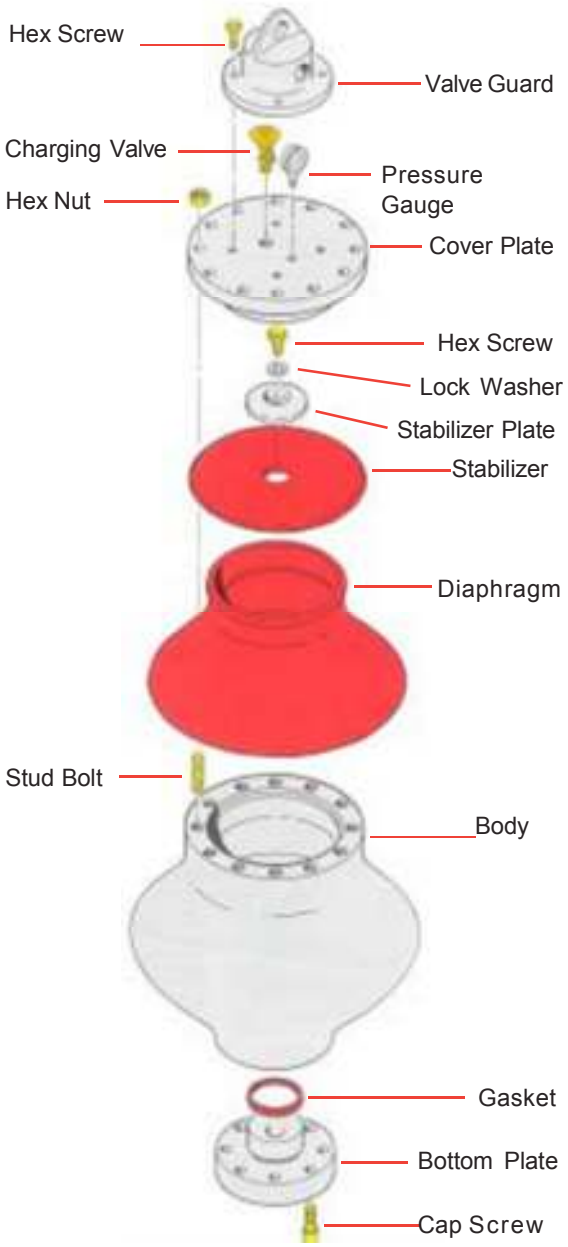

Figure 2-3

b. Rotate backward if the previous step is ***not possible*** until the valve is positioned in the proper direction (½ turn maximum).
c. After valve is in position, tighten lock nut to 20 ± 5 lb-ft or 27 ± 7 N•m torque.

2.3.20. Install pressure gauge so that the face is positioned in such a manner that it will be visible through the valve guard opening:
a. Unscrew lock nut on gauge and thread gauge into tapped hole.
b. Tighten to 20 ± 5 ft-lb or 27 ± 7 N•m torque.
c. If the gauge is not facing in the proper direction, take the following steps:
1) Rotate forward if ***less*** than a ½ turn is required to position gauge in proper direction.
2) Rotate backward if the previous step is ***not possible*** until the gauge is positioned in the proper direction (½ turn maximum).
3) After gauge is in position, tighten seal nut to 20 ± 5 lb-ft or 27 ± 7 N•m torque.

2.3.21 Set the pre-charge using the pre-charge instructions given in Section 1.

2.3.22 Attach valve guard, and the pulsation dampener is now ready for use.

2.4 Performance Analysis

See also Figure 2-2 for fault analysis tree.

2.4.1. Pre-charge

a. When properly installed and pre-charged, the pulsation dampener is virtually maintenance free.
b. The vessel should be checked periodically for proper pre-charge and leaks. Unless conditions such as ambient temperature, operating conditions, or operating temperatures change, checking every six months should be sufficient.

2.4.2. Low Pre-charge Effects

a. If the pre-charge pressure is **TOO LOW,** the pulsation dampener will fill with excess fluid, thus losing some of the working volume of the gas and reducing dampener efficiency.
b. Additionally, excessive flexing of the diaphragm may cause premature rubber failure at the neck or equator of the diaphragm.

2.4.3. High Pre-charge Effects

a. If the pre-charge is **TOO HIGH**, the diaphragm insert will rest on the bottom of the dampener, closing off the fluid inlet.
b. Until the system pressure exceeds the pre-charge pressure, no dampening will take place.
c. During the time the pre-charge pressure is nearly equal with the system pressure, the diaphragm will bounce on and off the inlet opening which could affect the service life of the diaphragm.

2.4.4. Pre-charge Adjustments

A. Pre-charge Low

1. Original pre-charge may have been too low.
2. Ambient temperature may have decreased.
3. Check charging valve for leaks.
   a. Apply leak detection fluid to threads and valve openings.
   b. Tighten loose threads, close valve stem, or replace valve if stem does not close. **CAUTION**: **Make sure dampener pressure is at zero psig before removing charging valve**.
4. Check pressure gauge for leaks.
   a. Apply leak detection fluid to threads, face, and back cover.
   b. Tighten loose threads. Replace gauge if leaks continue. **CAUTION**: **Make sure dampener pressure is at zero psig before removing pressure gauge**.
5. Check for leaks between cover and body.
   a. Apply leak detection fluid to studs and cover-body contact surfaces.
   b. Tighten stud nuts. If leaks persist, remove cover and clean mating surfaces. Reassemble and repeat leak test.
6. Check Diaphragm (if all the above fail to find the leak). If the dampener will not hold pre-charge pressure, it may be due to nitrogen leaks through the diaphragm. Check for evidence of fluid at either charging valve or pressure gauge port hole. **CAUTION**: **Make sure dampener pressure is at zero psig before removing charging valve or pressure gauge**. If fluid is present, re- place diaphragm. See Disassembly and Assembly Sections.

B. Pre-charge High

1. Original pre-charge may have been too high.
2. Ambient temperature may have increased. Release pressure.
3. Diaphragm may be trapping pressure (system fluid) when pump is shut down. This will be indicated by a higher than normal pressure reading on the gauge, which is usually of a different value, each time the pump, shuts down. This condition usually occurs when the fluid is highly viscous. Installation of a diaphragm stabilizer should cure this condition.

CAUTION: If it is determined that any items need to be replaced or dampener cover removed, PLEASE FOL-LOW THE DISASSEMBLY AND ASSEMBLY PROCE-DURES.

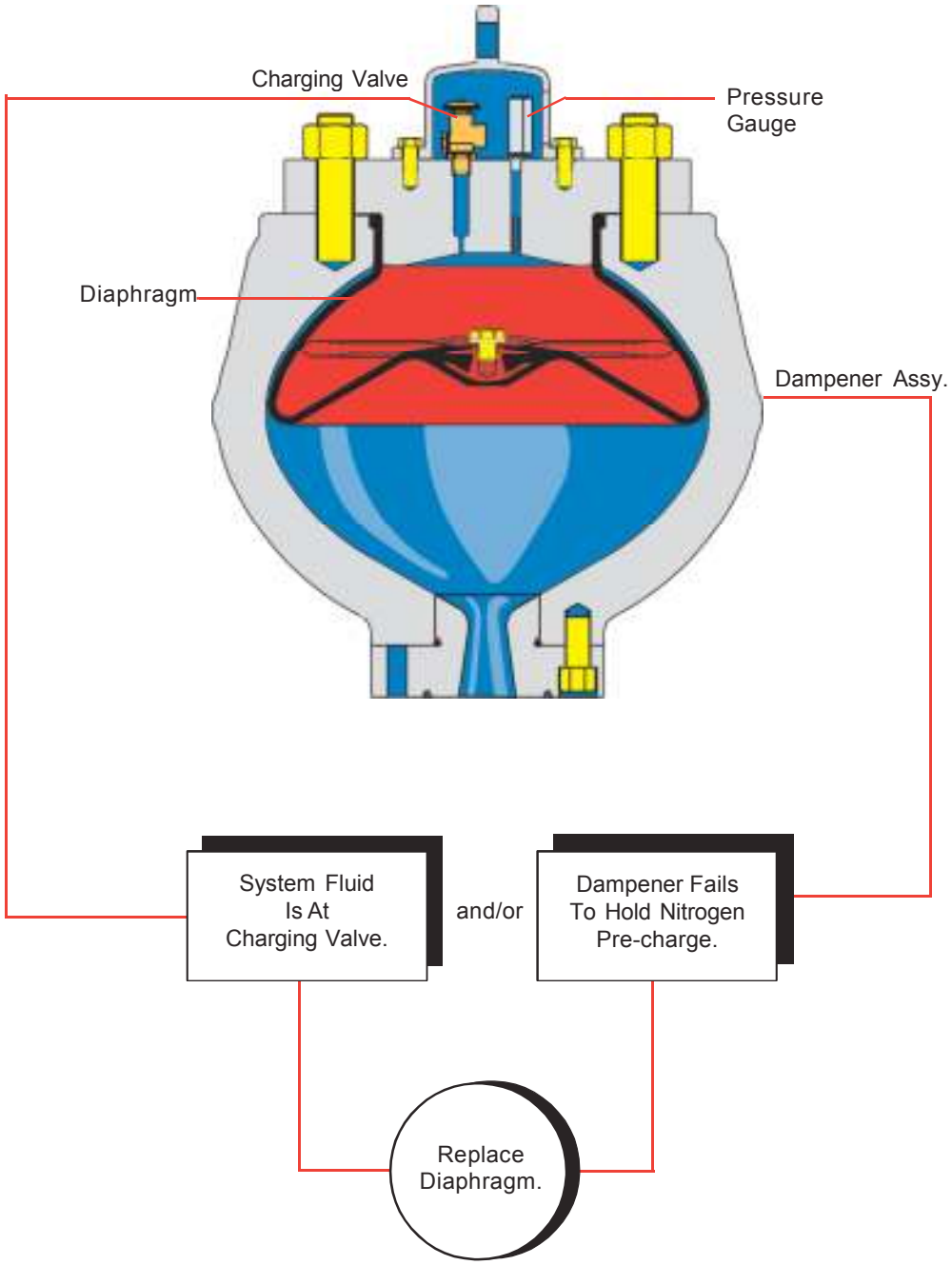

Figure 2-2. Kana-Series Fault Analysis Tree

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3.0 Physical Data

3.1 Kana 10-Series - Parts and Materials of Construction Parts

BILL OF MATERIAL			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	80-300023	BODY
2	1	80-300024	BOTTOM PLATE
3	1	80-300022	COVER PLATE
4	1	80-300025	PROTECTOR CAP
5	12	80-300013	PAD STUD, 1.500-8UN-2A
6	12	80-300014	HEAVY HEX NUT, 1.500-8UN-2B
7	1	80-300016-18	DIAPHRAGM KIT
8	2	80-300012	CAP SCREW, HEX HEAD, .625-11UNRC-3A
9	8	80-300015	SOCKET HEAD CAP SCREW, 1.250-8UNRC-3A
10	8	80-300027	PAD STUD, 1.250-8UN-2A
11	8	80-300028	HEAVY HEX NUT, 1.250-8UN-2B
12	1	80-300021	SEAL RING
13	1	80-300010	CHARGING VALVE
14	1	80-300011	PRESSURE GAUGE

• Contents of Pressure Control Hardware Kit (recommended spare parts -one year service)
* Refer to Section 3.6 for available diaphragms.
** AA: Diaphragm Material (Refer to Section 3.6 for diaphragm material dash number.)

Materials of Construction

* Refer to Section 3.6 for available diaphragms.

Description	K10-5000	Qty.
Assembly		1
Body	Carbon Steel	1
Cover Plate	Carbon Steel	1
Guard	Carbon Steel	1
Diaphragm	*	1
Bottom Plate	Carbon Steel	1
Bottom Plate Gasket	HSN	1
Diaphragm Stabilizer	Nitrile Buna N	1
Stabilizer Plate	Carbon Steel	1
Stabilizer Screw	Alloy Steel	1
KANA Logo Label	---	2
Lock Washer	Alloy Steel	1
Charging Valve Assy	Brass	1
Nameplate	---	1
Lock Nut	Brass & Teflon	1
Lock Nut	---	1
Hex Nut	Alloy Steel	12
Cap Screw	Alloy Steel	8
Cap Screw	Alloy Steel	4
Drive Screw	Alloy Steel	4
Stud Bolt	Alloy Steel	12
Pressure Gauge	---	1
Tag, Caution	Stainless Steel	1

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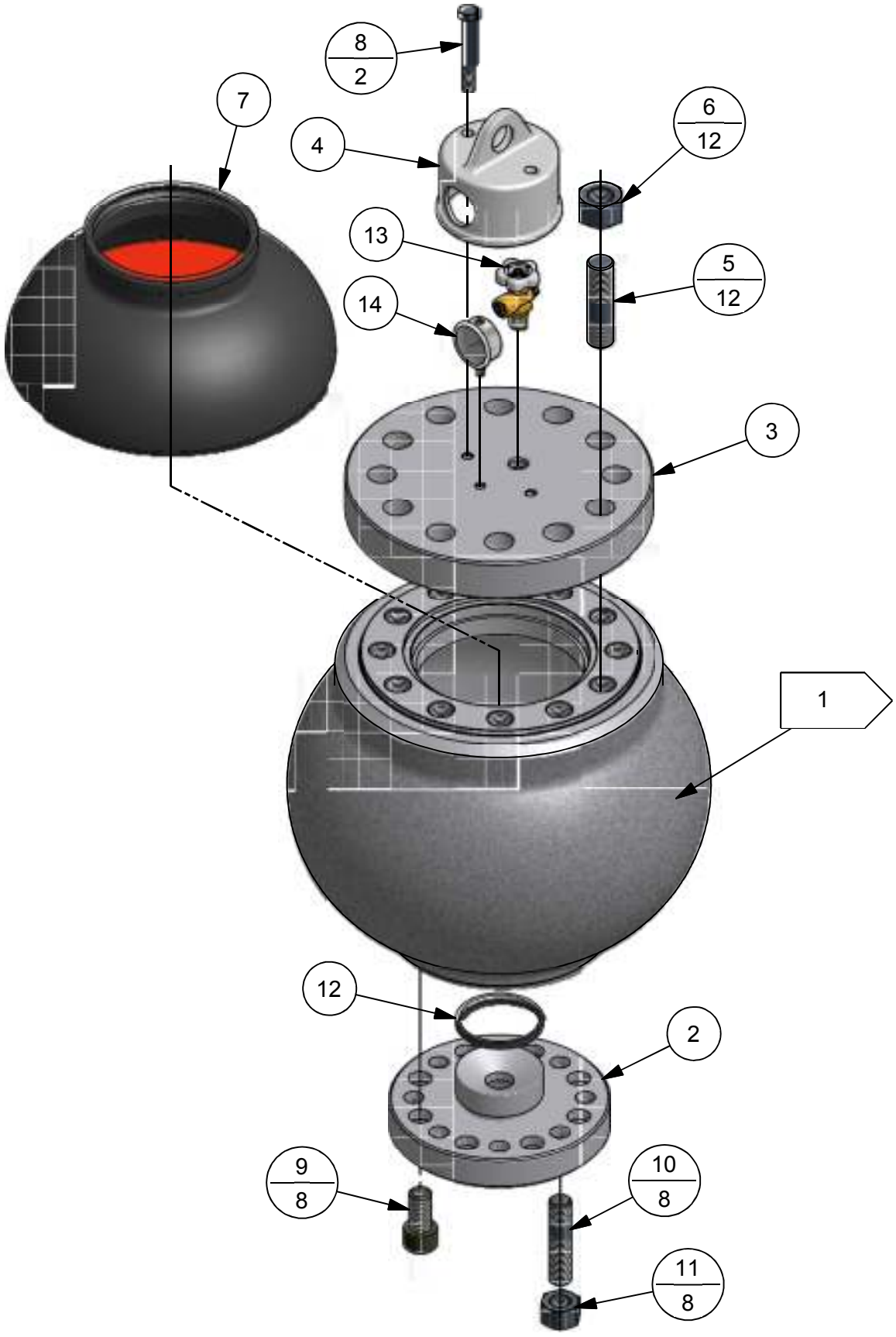

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3.2 Kana 20-Series - Parts and Materials of Construction Parts

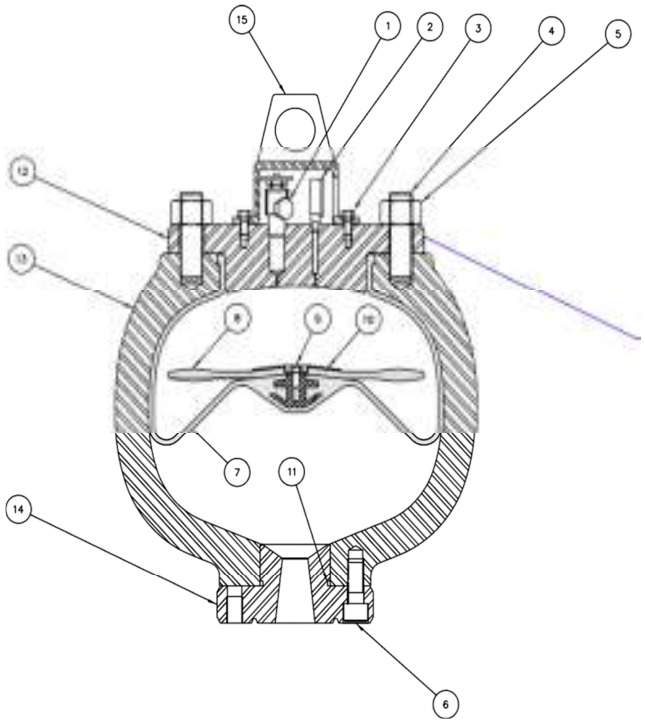
BILL OF MATERIAL			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	71-200-014	CHARGE VALVE
2	1	71-200-013	PRESSURE GUAGE
3	4	71-200-012	HEX HD CAP SCR ½" – 13 NC X 1.25 LG GR 8
4	12	71-200-011	STUD BOLT 1-3/4"- 8 NS X 6" LG GR 8
5	12	71-200-010	HEAVY HEX NUT 1-3/4"- 8 NS GR 8
6	8	71-200-009	SOC HD CAP SCR 1-1/4" – 8NS X 2- 3/4" LG GR8
7	1	71-100-001	DIAPHRAGM
8	1	71-100-003	DIAPHAGM STABILIZER
9	1	71-200-008	HEX HD CAP SCREW, ½"-13 UNC X ¾" LG GR 8
10	1	71-200-007	STABILIZER PLATE
11	1	71-100-002	QUAD RING SEAL
12	1	71-200-005	TOP COVER
13	1	71-200-001	BODY
14	1	71-200-004	OUTLET FLANGE
15	1	71-200-006	PROTECTIVE COVER

• Contents of Pressure Control Hardware Kit (recommended spare parts -one year service)
* Refer to Section 3.6 for available diaphragms.
** AA: Diaphragm Material (Refer to Section 3.6 for diaphragm material dash number.)

Materials of Construction

* Refer to Section 3.6 for available diaphragms.

Description	K20-5000	Qty.
Assembly		1
Body	Carbon Steel	1
Cover Plate	Carbon Steel	1
Guard	Alloy Steel	1
Diaphragm	*	1
Bottom Plate	Carbon Steel	1
Bottom Plate Gasket	HSN	1
Diaphragm Stabilizer	Nitrile Buna N	1
Stabilizer Plate	Carbon Steel	1
Stabilizer Screw	Alloy Steel	1
KANA Logo Label	---	2
Lock Washer	Alloy Steel	1
Charging Valve Assy	Brass	1
Nameplate	---	1
Lock Nut	Brass & Teflon	1
Lock Nut	---	1
Hex Nut	Alloy Steel	12
Cap Screw	Alloy Steel	8
Cap Screw	Alloy Steel	4
Drive Screw	Alloy Steel	4
Stud Bolt	Alloy Steel	12
Pressure Gauge	---	1
Tag, Caution	Stainless Steel	1



3.4 Cover Plate and Mating Flange – Bolting Data

Kana 10-Series

Cover Bolting				Bottom Plate Mating Flange Bolting					
Model	Qty.	Thread Size (In)	Torque (Lb-Ft)	Mating Flange Size	Qty.	Thread Size (In)	Lg. (In)	Torque Lb-Ft	Gasket
K10-5000	12	1 1/2-8UN	1677	4 1/16" API 5000 RTJ	8	1 1/4-07NC	2 1/2	953	HSN

Kana 20-Series

Cover Bolting				Bottom Plate Mating Flange Bolting					
Model	Qty.	Thread Size (In)	Torque (Lb-Ft)	Mating Flange Size	Qty.	Thread Size (In)	Lg. (In)	Torque Lb-Ft	Gasket
K20-5000	12	1 7/8-8NC	3332	4 1/16" API 5000 RTJ	8	1 1/4-07NC	2 1/2	953	HSN

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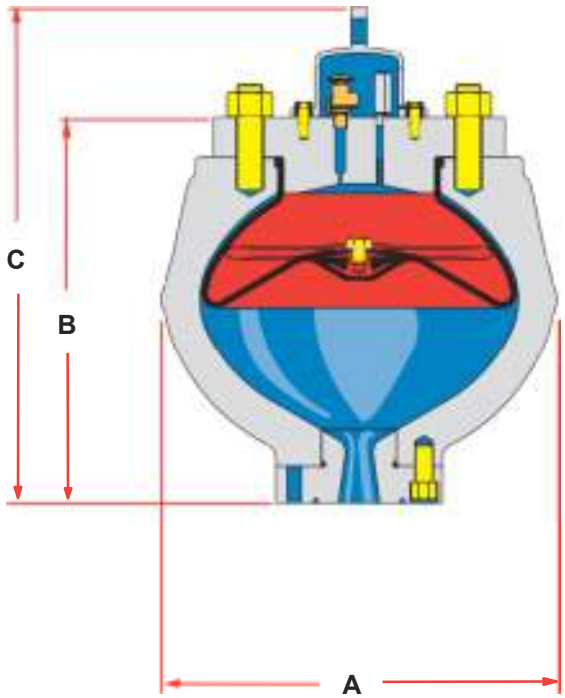
3.5 Capacity, Pressure, Dimensions, and Weight



Model No.	Capacity (U.S. Gal)	Pressure PSI	Dimensions - (In)			Weight (Lb)
			A	B	C	
K10-5000	10	5,000	23.000	23.750	31.100	950
K20-5000	20	5,000	28.500	28.150	35.530	2,145

3.6 Diaphragms

Type Generic Elastomers	AA No.	Temperature Range*		Recommended Use (Resistant To)	Non Recommended Use (Attacked By)
		Continuous	Intermittent		
Buna-N (Nitrile)	-01	0° F-212° F (-18° C to 100° C)	250° F (121° C)	Non-polar hydrocarbons, crude oil, grease, diesel oil, jet fuels, leaded gasoline, alcohols, petroleum base hydraulic fluids, salt solutions, water allyl alcohol, ammonium sulfide, amyl ether, animal fats, anti-freeze, ASTM Oils # 1, 2, 3, barium salts, boric acid, brines, butane, calcium slats, carbonic acid, castor oil, copper chloride, cyclohexane, denatured alcohol, methanol, ethyl chloride, fuel oil, glucose, glycerin, lime, linseed oil, LPG, petroleum based lubrication oils, methane, mineral oil, naphtha, potassium bromide, potassium chloride, pro- pane, slat water, sewage, sodium carbonate, sodium sulfide, soybean oil, stearic acid, tannic acid, stoddard solvent, tetrachlroethylene, transformer oil, turbine oil, turpentine, zinc sulfate	Ozone, ketones, esters, aldehydes, chlorinated solvents, sour gasoline, gasohol, sour (H2S) crude oil and gas, creosote, aniline, Skydrol 500 & 7000, Pydraul, Benzyl alcohol, acetic acid, acetone, ammonium carbonate, amyl acetate, benzene, bleach solutions, bromines, butyl acetate, carbon disulfide, chlorinated solvents, chlorine (wet or dry), chloroform, chrome plating solutions, diethyl ketone, Dowtherm A, ethyl formate, ethyl formate, ethylene chloride, ethylene bromide, hydrochloric acid (hot or cold), hydrofluoric acid, methyl chloride, nitric acid, phosphoric acid, steam, molten sulfur sulfuric acid, toluene, anhydrous ammonia, zinc bromide.
Butyl	-02	-40° F to 212° F (-40° C to 100° C)	275° F (135° C)	Acetone, alcohols, gylcols, MEK, Pydraul, Skydrol 500 & 7000, water, salt solutions, hydrogen sulfide, allyl alcohol, ammonium carbonate, ammonium sulfide, amyl alcohol, aniline oil, barium sulfate, bleach solutions, copper carbonic acid, citric acid, copper chloride, denatured alcohol, methanol, methyl chloride, fluorocarbon oils, glucose, glycerin, hydrochloric acid (25%), hydrofluoric acid (10%), isopropyl alcohol, lead acetate, lead sulfamate, lime, magnesium hydroxide, methyl alcohol, phosphoric acid, potassium salts, salt water, sodium carbonate, sodium sulfide, sulfuric acid (25%), tannic acid.	Hydrocarbons, diesel oil, fuel oils, gasoline, LPG, jet fuels, strong acids, ester, chlorinated solvents, carbon disulfide, benzyl alcohol, amyl ether, benzene, bromines, bunker oil, butane carbon disulfide, chlorine, chloroform, creosote, cyclohexane, dry cleaning fluids, methane, fluorine, hydrofluoric acid (Hot, concentrated), tetrachloroethylene, toluene, transformer oil, turbine oil, turpentine, wood oil.
EPDM	-03	-40° F to 250° F (-40° C to 121° C)	300° F (149° C)	Steam, dilute acids, bases, Skydrol 500 & 7000, Pydrauls, anti-freeze (glycol based), ketones, alcohols, salt solutions, hydrogen, acetic acid, ammonium hydroxide, allyl alcohol, aluminum acetate, acetone, ammonium sulfide, amy alcohol, barium sulfate, bleach solutions, cop- per sulfate, boric acid brine, butyl alcohol, calcium salts, carbonic acid citric acid, copper chloride, methanol, ethylene chlorohydrin, eth- ylene glycol, fluorocarbon oils, formaldehyde, glucose, glycerin, glycerol, glycols, hydrogen peroxide, hydrogen sulfide, isopropyl alcohol, lead acetate, lead sulfamate, lime magnesium hydroxide, methyl alcohol,phosphoric acid, chrome plating solution, potassium slats, salt water, sodium carbonate, sodium sulfide, steam, sulfuric acid (25%), tannic acid, zinc sulfate	Petroleum hydrocarbons, LPG, fuel oil, gasoline, jet fuel, diesel oil, solvents, esters, carbon disulfide, benzyl alcohol, amyl ether benzene, bromines, bunker oil, butane, butyl acrylate, carbon disulfide, chlorinated solvents, chlorine (dry or wet), chloroform, cyclohexane, Dowtherm A, dry cleaning fluids, ethyl ether, fluorine, kerosene, lacquers, lubrication oils, methane, methyl cyclopentane, mineral oil, mineral spirits, naphtha, nitric acid, propane, tetrachloroethylene, toluene, transformer oil, turbine oil, turpentine, wood oil, stoddard solvent.
Hydrin	-04	-40° F to 250° F (-40° C to 121° C)	275° F (135° C)	Unleaded gasoline, gasohol, non-polar hydrocarbons, salt solutions, jet fuel, crude oil diesel oil, water, silicone oil, amyl alcohol, arsenic acid, asphalt, ASTM fuel A, ASTM oil #1, 2, 3, barium sulfate, barium slats, borax, boric acid, brines, butane, calcium chloride, calcium hydroxide, carbonic acid, castor oil, chlorox, cutting fluid, cyclohexane, denatured alcohol, diesel oil, Methanol, ethylene glycol, fuel oil, gasoline glucose, glycerin, glycerol, isopropyl alcohol, kerosene, linseed oil, LPG, lubrication oils, magnesium hydroxide, methane, methyl alcohol, mineral oil, naphtha, natural gas potassium slats, propane, sodium carbonate, stoddard solvent, turbine oil, turpentine.	Aldehydes, sour gasoline, sour crude, hydrogen sulfide, esters, chlorinated solvents, benzene, strong acids, ketones, anilines, Skydrol 500 & 7000, Pydrauls, creosote, acetic acid, amyl acetate, banana oil, benzene, bromine trifluoride, bromobenzene, butadiene, butyl acetate, carbon bisulfide, carbon tetrachloride, chlorine trifluoride, Dowtherm Oil, methyl acetate, methyl benzene, methyl formate, ethylene dichloride, methyl ethyl ketone, nitric acid, steam, sulfuric acid toluene.

(continued)

3.5 Diaphragms (Continued)

Type Generic Elastomers	~~AA~~ No.	Temperature Range* Continuous	Temperature Range* Intermittent	Recommended Use (Resistant To)	Non Recommended Use (Attacked By)
Hypalon	-05	-10° F to 250° F (-23° C to 121° C)	275° F (135° C)	Mineral acids, alcohols, formaldehyde, water, salt solutions, allyl alcohol, ammonium sulfide, anti-freeze, bleach solutions, copper sulfate, boric acid brines, butyl alcohol, calcium carbonate, calcium chloride, calcium salts, carbon dioxide, carbonic acid, castor oil, chlorox, citric acid, copper glycols, hydrochloric acid (cold), hydrofluoric acid (cold), hydrogen peroxide, isopropyl alcohol, lead nitrate, lie, magnesium hydroxide, methyl alcohol, phosphoric acid, potassium slats, salt water, sewage, sodium carbonate, sodium nitrate, sodium sulfide, sulfuric acid, tannic acid, urea, zinc sulfate.	Benzyl alcohol, fuming acid, acetic acid, Skydrol 500 & 7000, Pydrauls, ethers, fuels, gasoline, amyl acetate, amyl ether, anilines, aniline oil, ASTM Fuels A, B, C, Barium chloride, benzene, bromines, bunker oil, butyl amines, carbon disulfide, dry chlorine, chloroform, chrome plating solutions, cyclohexane, diethyl ketone, Dowtherm Oil, dry cleaning fluids, ethylene chloride, hydrochloric acid (hot), hydrofluoric acid (hot), methyl chloride, chrome plating solutions, steam, stoddard solvent, tetrachloroethylene, toluene, turbine oil, turpentine.
Natural Rubber	-06	-40° F to 158° F (-40° C to 70° C)	250° F (121° C)	Abrasive slurries, dilute acids, salt solutions alcohols, water ally alcohol, aluminum acetate, aluminum salts, ammonium salts, copper sulfate, boric acid, brines, butyl alcohol, calcium salts, carbon dioxide, carbonic acid, castor oil, citric acid, denatured alcohol, detergent solutions, methanol, ethylene glycol, glucose, glycerin, glycols, hydrochloric acid (37%-cold), hydrofluoric acid (10%), isopropyl alcohol, lead acetate, lead sulfamate, lime methyl alcohol, potassium salts, salt water sodium carbonate, sodium sulfide, sulfuric acid (25%), tannic acid, urea, zinc sulfate.	Hyrocarbons, waste water from drilling or production, nitric acid, strong acids, fats, acetyl chloride, ammonia gas (hot), amyl acetate amyl ether, amyl salts, anti-freeze, ASTM Fuels A, B, C, ASTM Oils 1, 2, 3, benzene, bromines, bunker oil, butane, butyl acetate, butyl compounds, carbon disulfide, chlorinated solvents, chlorine, cyclohexane, diesel oil, diethyl ketone, Dowtherm A, methyl formate, methylene chloride, fluorine, fuel oil, gasoline, hydrochloric acid, hydrofluoric acid (25%), hydrogen sulfide, jet fuels, linseed oil, LPG, lubrication oils, methyl chloride naptha, propane, Pydrauls, Skydrol 500 & 7000, steam stoddard solvent, molten sulfur, sulfuric acid (50%), tetrachloroethylene, toluene, transformer oil, turbine oil.
Hydrogenated Nitrile (HSN)	-07	0° F to 250° F (-18° C to 121° C)	300° F (149° C)	Hydrogen sulfide (<3%), carbon dioxide, nonpolar hydrocarbons, crude oil, grease, diesel oil, jet fuels, leaded gasoline, alcohols, petroleum base hydraulic fluids, salt solutions, water, allyl alcohol, ammonium sulfide, amyl e t h e r, ASTM Oils #1, 2, 3, barium salts, boric acid, brines, butane, calcium, salts, carbonic acid, castor oil, copper chloride, cyclohexane, denatured alcohol, methanol, ethyl chloride, ethylene, ethylene glycol, fuel oil, glucose, glycerin, glycerol, lime, LPG, petroleum based lubrication oils, methane, mineral oil, mineral spirits, naptha, potassium bromide, potassium chloride, propane, salt water, sewage, sodium carbonate, sodium sulfide, stearic acid, tannic acid, tetrachloroethylene, transformer oil, turbine oil, turpentine, urea, zinc sulfate, stoddard solvent, sour crude oil and gas.	Ozone, ketones, esters, aldehydes, chlorinated solvents, sour gasoline, gasohol, creosote, aniline, Skydrol 500 & 7000, Pydraul, Benzyl alcohol, acetic acid, acetone, ammonium carbonate, amyl acetate, benzene, bleach solutions, bromines, butyl acetate, carbon disulfide, chlorinated solvents, chlorine (wet or dry), chloroform, chrome plating solutions, diethyl ketone, Dowtherm A, ethyl formate, ethylene chloride, ethylene bromide, hydrochloric acid (hot or cold), hydrofluoric acid, methyl chloride, nitric acid, phosphoric acid, steam, molten sulfur, sulfuric acid, toluene.
Flurocarbon (Viton)	-08	20° F to 375° F (-7° C to 191° C)	400° F (204° C)	Aliphatic and aromatic hydrocarbons, halogenated hydrocarbons, jet fuels, fuel oil, diesel oil, gasoline, sour alcohols, tetrachloroethylene, anilines (150 F) benzyl alcohol, mineral acids, Dowtherm A, acetylene, ammonium carbonate, ASTM Fuels, A, B,C, ASTM Oils #1, 2, 3, barium sulfate, petroleum ether, copper sulfate, boric acid, bromine, anhydrous bromine, bromine water, butane, butyl alcohol, carbon sulfide, carbonic acid, castor oil, chlorinated solvents, chlorine, chloroform, chlorox, copper chloride, cyclohexane, ethyl alcohol, methyl chloride, methyl formate, hydrochloric acids, hydrofluoric acids, isopropyl alcohol, lead sulfamate, LPG, lubrication oils, magnesium hydroxide, methyl chloride, phosphoric acid, potassium salts, Pydrauls, sodium sulfide, stoddard solvent, sulfuric acid, tannic acid, tetrachloroethylene, toluene, transformer oil, turbine oil, turpentine, zinc sulfate.	Steam, methyisobutyl ketone, ethylene oxide, acetic acid, Skydrol 500 & 7000, ketones, nitrohydrocarbons, anhydrous ammonia, butyl amine, acetic acid, acetone, aluminum acetate, amyl acetate, amyl amines, bromine trifluoride, butyl acetate, butyl amine, chlorosulfonic acid, copper acetate, formamide, hydrogen sulfide, lead acetate, methanol, zinc acetate, arctic diesel, formaldehyde.

(continued)

3.6 Diaphragms (Continued)

Type Generic Elastomers	~~AA~~ No.	Temperature Range*		Recommended Use (Resistant To)	Non Recommended Use (Attacked By)
		Continuous	Intermittent		
EPR (Vistalon)	-09	-40° F to 250° F (-40° C to 121° C)	300° F (149° C)	Steam, dilute acids, bases, Skydrol 500 & 7000, Pydrauls, antifreeze (glycol based), ketones, alcohols, salt solutions, hydrogen acetic acid, ammonium hydroxide, allyl alcohol, aluminum acetate, acetone, ammonium sulfide, amy alcohol, barium sulfate, bleach solutions, cop- per sulfate, boric acid, brine, butyl alcohol, calcium salts, carbonic acid, citric acid, cop- per chloride, methanol, ethylene chlorohydrin, ethylene glycol, glycols, hydrogen peroxide, hydrogen sulfide, isopropyl alcohol, lead acetate, lead sulfamate, lime, magnesium hydroxide, methyl alcohol, phosphoric acid, potassium salts, salt water sodium carbonate, sodium sulfide, steam, sulfuric acid (25%),	Petroleum hydrocarbons, LPG, fuel oil, gasoline, jet fuel, diesel oil, solvents, esters, carbon disulfide, benzyl alcohol, amyl ether, benzene, bromines, bunker oil, butane, butyl acrylate, car- bon disulfide, chlorinated solvents, chlorine (dry or wet), chloroform, cyclohexane, Dowtherm A, dry clean fluids, ethyl ether, fluorine, kerosene, lacquers, lubrication oils, methane, methyl cyclopentane, mineral oil, mineral spirits, naphtha, nitric acid, propane, tetrachlorethylene, toluene, transformer oil, turbine oil, turpentine, wood oil, stoddard solvent.
Neoprene	-10	-20° F to 212° F (-29° C to 100° C)	250° F (121° C)	Allyl alcohol, aluminum acetate, aluminum slats, anhydrous ammonia, ammonium sulfide, amyl alcohol, antifreeze, ASTM Fuel A, ASTM Oil #1, barium sulfate, copper sulfate, boric acid, brines, butane butyl alcohol, calcium carbonate, calcium chloride, calcium hydroxide, calcium sulfate, carbonic acid, castro oil, chlorox, citric acid, denatured alcohol, ethyl alcohol, ethylene glycol, glucose, glycerin glycols, hydrochloric acid (10%), hydrofluoric acid (10%), hydrogen peroxide (3%), isopropyl alcohol, lead acetate, lead sulfamate, lime magnesium salts, methyl alcohol, phosphoric acid (50%), potassium salts, sodium carbonate, sodium nitrite, sodium sulfide, sul-	Acetic acid, acetyl chloride, amyl acetate, amyl ether, aniline, ASTM Fuel C, benzene, bleach solutions, bromines, butyl acetate, butyl amine, calcium hypochlorite, carbon disulfide, chlorinated solvents, chlorine, chloroform, chrome plating solutions, diethyl ketones, Dowtherm A, dry cleaning fluids, ethyl ether, ethylene chloride, hydro- chloric acid (37%- hot), hydrofluoric acid (25%), hydrogen peroxide (concentrated), lacquer sol- vents, methyl chloride, nitric acid, phosphoric acid (concentrated), chrome plating solutions, Pydrauls, Skydrol 500 & 7000, steam, molten sulfur, sulfuric acid (75%), tetrachlorethylene, toluene, turbine oil, turpentine, borax.

* Temperature range is the dynamic characteristic desired from diaphragm and may vary from conventional elastomer ratings.

3.7 Storage of Diaphragms

Store KANA® diaphragms in original box in a dry, cool (ideally below 80°F) and dark location – especially away from direct sunlight. Keep diaphragm in a relaxed position and away from electrical machinery and areas of high ozone content. Always use the practice of *first in*, *first out* when storing diaphragms.