

WEKO-SEAL – Internal Joint Sealing Information

Miller Pipeline Corporation's **WEKO-SEAL** is the industries leading trenchless technology system for internally and economically renewing leaking joints in water, wastewater, natural gas, and industrial piping from 14" through 216" and larger. Over the past 25 years, Miller Pipeline Corporation has installed over 150,000 failure free installations in locations throughout the United States, Canada, and Mexico. Dozens of gas utilities, municipalities, and industrial plants have made the **WEKO-SEAL** a vital part of their water, wastewater, and gas pipeline maintenance and rehabilitation efforts. The **WEKO-SEAL** is a flexible rubber leak clamp that ensures a noncorrodible, bottle-tight seal around the full inside circumference of the pipe joint area. The proprietary and patented design incorporates special lip seals that create a positive leakproof fit on either side of the joint and can be installed on an array of pipeline configurations. In fact, Miller Pipeline's **WEKO-SEAL** is the choice repair method for multiple nuclear and fossil fuel plants across the United States for their cooling water, circulation water, service water, fresh water, and seawater applications. **The WEKO-SEAL** will continue to set the standards for competing products and remain the industry's most recognized internal joint sealing technology.



ADVANTAGES & BENEFITS

- **Permanent** Noncorrodible, bottle-tight seal handles operating pressures in excess of 300 psi and head pressures of 100 feet in liquid lines, and maximum allowable pressure up to 60 psi on natural gas lines.
- **Flexible** Can accommodate normal pipe movement resulting from ground shifting, thermal expansion and contraction, and vibration.
- **Cost Effective** Savings of up to 60% over conventional repair methods.
- **No Loss of Flow** The seal's low profile design causes minimal reduction of the pipeline's internal diameter.
- **Approved for Potable Water Applications** Standard ANSI/NSF 61-1991 Drinking Water Approved.
- **Proven** Miller Pipeline's installation crews have installed over 150,000 seals in the last 25 years and continues to grow.

WEKO-SEAL[®] EPDM Material Specifications

(Water/Waste Water Applications)

Manufactured in compliance with ASTM D3900 and D3568 and shall have designation of M4AA710A13B13C12ZIZ2Z3 in accordance with ASTM D2000, where Z1, Z2, and Z3 are defined as follows:

Suffix Z1: The material shall be an EPDM polymer where all ingredients are listed in FDA Title 21 Code of Federal Regulations Section 177.2600 Rubber Articles Intended for Repeated Use with the final material not supporting microbiological growth when used in potable water or sea water or in humid aerobic conditions.

Suffix Z2: The volume change of the rubber shall not exceed 3% after immersion in fresh or seawater at 100°C for 70 hours.

Suffix Z3: The stress relaxation shall not exceed 12% when tested from the time of 30 minutes to 24 hours in accordance with British Standard Method of Testing Vulcanized Rubber Part A42 determination of stress relaxation.

R-H Compound: 206 (EPDM) “WEKO-SEAL” material:

<u>Physical Properties</u>	<u>Specification</u>	<u>Typical Results</u>
Durometer (pts) ASTM D-2240	70 ± 5	72
Tensile (psi) ASTM D-412	1,450 min.	1,700
Elongation (%) ASTM D-412	250 min.	400

Suffix A13 ASTM D-573

Heat Aged 70h 70°C

Durometer (pts)	± 15	± 6
Tensile change, (%)	± 30	± 4
Elongation change, (%)	- 50 max.	- 22

<u>Physical Properties</u>	<u>Specification</u>	<u>Typical Results</u>
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Suffix B13 ASTM D-395B

Compression Set, 22h 70°C

(%) Permanent set	25 max.	13
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Suffix C12 ASTM D-1171

(%) Ozone resistance	85 min.	100
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Suffix Z1

EPDM/FED REG. 177.26	Listed	Listed
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Suffix Z2 FLUID AGING D471

70 hrs. @ 100°C

(%) Volume swell in water	3 max.	1
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Suffix Z3

Stress relaxation, 100% Elong.

10-min., 10 min. Rest, (%)		+4
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The WEKO-SEAL shall be classified ANSI/NSF Standard 61 “Drinking Water System Components Health Effects.”

Manufacturing Process:

- a. Extrusion process used for belt material.
- b. All joints to be transfer molded.
- c. Vulcanization shall occur at 330°F with 2000-psi pressure.
- d. Manufactured to Miller Pipeline drawing numbers, 3600 0000 0149, 3600 0000 0248, and 3600 0000 0347.
- e. All material specifications must be certified.
- f. Material Safety Data Sheet (MSDS) must be provided.

Stainless Steel Retaining Bands:

- 1. This specification references American Society of Testing and Materials (ASTM) standards and American Welding Society (AWS) standards, which are made part thereof by such reference shall be the latest edition, and revised.
- 2. All bands, wedges, shims, and set screws for securing rubber membrane across piping joints shall be UNS S30400 (Type 304), UNS S31600 (Type 316), UNS S31603 (Type 316L), or UNS N08367 (AL-6XN) and shall conform to ASTM A240 Standard Specifications for heat-resisting chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels. The weld wire ER316, ER316L shall conform to AWS A5.22 and Alloy 625 (ERNiCrMo-3) shall conform to AWS A5.14.
- 3. All material such as push tabs, shims, and wedges shall be made compatible with the base metal selected.
- 4. Welding wire used for selected base metal:

Retaining Band	Weld Wire
UNS S30400 (Type 304)	ER316
UNS S31600 (Type 316)	ER316
UNS S31603 (Type 316L)	ER316L
UNS N08367 (AL-6XN)	ERNiCrMo-3

- 5. The retaining band shall be rolled to the radius of the pipe that being repaired. The radius shall be obtained from measurement data acquired from the inspection report. Each band to be checked on a fixed radius gauge.
- 6. The cleated ends shall be manufactured from the same lot number as the band. Certified welders shall make all shop and field welds with a minimum of 2 years experience on this alloy (T-304). The welds shall be made with a stick or wire of T-316 alloy, as mentioned in the above table.
- 6. Welding shall be accomplished in using either gas metal arc welding or shielded metal arc welding.

7. All material specifications shall be certified.
8. All material sourcing and manufacturing is performed in the U.S.A.
9. All shims to be manufactured to the radius of the pipe and shall be 16-22 gauge x 2" x 6" composed of the same alloy selection as band material. All edges shall be deburred.
10. All retaining bands to be manufactured from stainless steel materials with the following minimum physical properties:

Physical Properties	Type 304	Type 316	Type 316L	Type AL-6XN
UNS Designation	S30400	S31600	S31603	N08367
Tensile Strength (min.)	75,000 psi	75,000 psi	70,000 psi	100,000 psi
Yield Strength (min.)	30,000 psi	30,000 psi	25,000 psi	45,000 psi
Elongation in 2in (min.)	40%	40%	40%	30%
Brinell Hardness (max.)	202	217	217	233
Weld Wire Tensile Strength (min.)	80,000 psi	70,000 psi	70,000 psi	110,000 psi

11. The retaining bands shall be made from the material selection above or designed from a material that will meet the customer's requirement. Typical selection is Type 304 for potable water, Type 316/316L for wastewater conditions, and AL-6XN for seawater environments. These materials have been selected for their exceptional physical properties as well as their ability to resist corrosion when subject to said environment.

Cement Mortar:

Cement Mortar for pipe joint sealing and preparation shall be the fast setting type suitable for sea water, wet/dry conditions. Cement mortar shall be as specified in ASTM-C150.

Liquid Joint Lubrication:

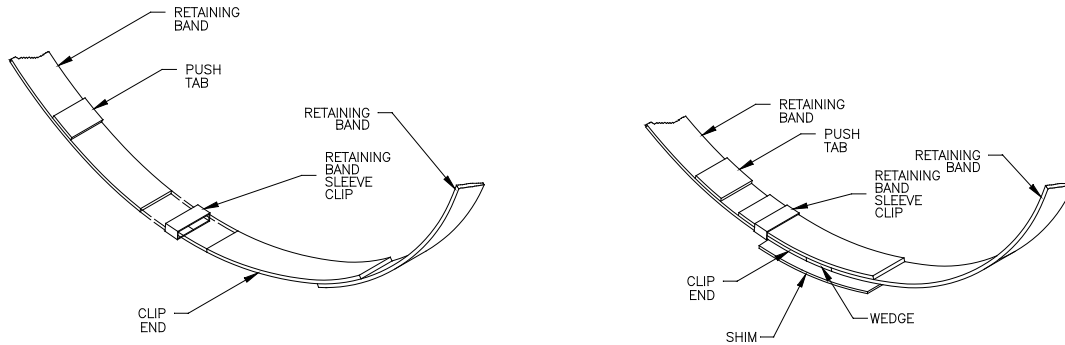
Liquid joint lubricant to assist in installation of the WEKO-SEAL and retaining bands shall be a non-toxic vegetable based lubricating gel with the following required properties:

1. Will not deteriorate or decompose while in storage for a minimum of two years.
2. A soft pasty consistency suitable for use intended from 0°F to 120°F.
3. Does not have any deteriorating effect on natural or synthetic rubber gaskets.
4. Will not impart taste or odor to water.
5. Has no objectionable odor.
6. Is non-toxic and does not support the growth of bacteria.
7. PH – 9.6 minimum – 11 maximum (pH Meter)
8. Method of test, Modified ASTM-D562-55
9. Does not contain any petroleum based oils or grease.
10. Does not contain any material considered toxic.

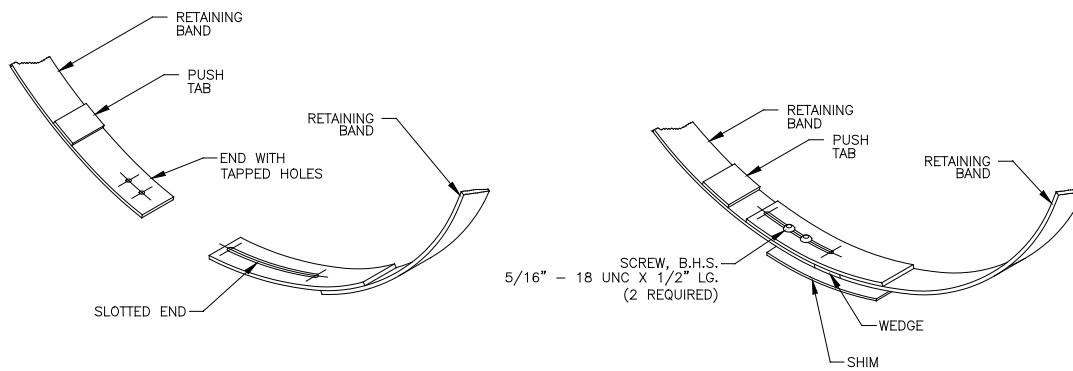
Thread Sealing Compound:

Thread sealing compound shall be a non-toxic Paste Type with “Teflon”
Teflon Components Required Properties:

Physical Data	
Flash Point	410 degrees F closed cup
Density	1.4 – 1.42
Viscosity	200,000 – 275,000
Temperature Range	-50 degrees F to 500
Pressure Application	Maximum 10,000 psi



DETAIL – RETAINING BAND SLEEVE CLIP
OVERLAP RETAINER



DETAIL – RETAINING BAND MECHANICAL LOCK
OVERLAP SCREW LOCK

WEKO-SEAL® MATERIAL COMPONENTS

- 1 Internal Joint Seal (WEKO-SEAL)
- 2 Retaining Bands
- 3 Retaining Band Shims
- 4 Retaining Band Wedge Assortment
- 5 Retaining Band clips
- 6 Pipe Lubricant
- 7 Hydraulic Expander
- 8 Air Test Assembly



WEKO-SEAL®

RECOMMENDED INSTALLATION PROCEDURES **FOR WATER AND WASTE-WATER PIPING**

1.0 OBJECTIVE:

WEKO-SEALS are manufactured from a non-toxic (EPDM) rubber compound, which are designed to internally and economically stop joint leakage or infiltration. These seals are flexible internal rubber leak clamps that ensure a noncorrodible, bottle tight seal around the full inside circumference of the pipe joint area. The following procedures are recommended to ensure proper installation of the WEKO-SEALS.

2.0 PREREQUISITES:

- 2.1 These procedures will be performed during pipeline shutdown and/or flow bypass. If required, pipeline to be removed from service and an adequate safety-tagging boundary established and verified.
- 2.2 All pipelines have been de-watered and are at atmospheric pressure.
- 2.3 Pipeline access has been provided and established.
- 2.4 Confined Space Entry Permit has been processed which covers the scope of work to be performed inside the pipe.
- 2.5 All permits have been processed which cover the scope of work to be performed.
- 2.6 Continuous forced air ventilation has been established and is sufficient to maintain the confined space for safe entry.
- 2.7 The owner before use has approved all consumables (i.e. hydraulic oil, lubricants, thread sealers, markers etc.), and MSDS sheets are on the job site.

NOTE: The above prerequisites do not have to be performed in the sequence listed.

3.0 **PRECAUTIONS:**

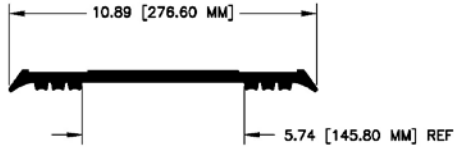
- 3.1 If any unanticipated or unexpected alarm, noise, vibration, odor, or excessive leakage is observed, immediately exit the pipe until the condition is identified and resolved.
- 3.2 All safety requirements as stated on the Confined Space Entry Permit shall be observed.

4.0 **PROCEDURE:**

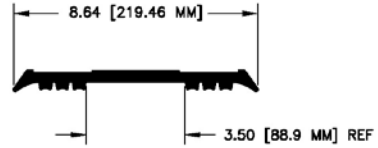
- 4.1 **VERIFY** that all WEKO-SEALS have been packaged in a proper manner that has not caused deformation or harm. This care must be maintained until the seal(s) are delivered to the designated job site location.
- 4.2 **EXAMINATION** of the seals shall be performed by a qualified installation technician, paying particular attention to the ribbed (lip seal) section of the seal. If the quality of material construction or condition is in doubt, the seals shall not be used.
- 4.3 **PERFORM** an inspection of the pipe interior. Review all seal installation locations to determine the cleaning requirements and note any anomalies that may need to be addressed with owner.
- 4.4 **REMOVE** dirt, scale, and other debris from the pipe walls in areas where the seals are to be installed. Cleaning shall be performed at least 3” beyond either side of proposed seal position. **REMOVE** all dirt and debris from the joint gaps, leaving a clean area for “**JOINT FILLING.**” These cleaning operations shall be accomplished by hand brushing and scraping, pneumatic wire brush, pneumatic grinder, and/or oil free air jet.
- 4.5 **FILL** joints to the full depth of the gap with a quick-setting cement mortar and render flush with the surrounding joint surface. All surplus material spillage shall be removed from the joint area. Surface preparation, mixing, placement, and curing of the quick-setting cement mortar shall be performed in accordance with the manufacturer’s placement guidelines.
- 4.6 **ALL** high/low surface imperfections running axially through or part way through the sealing surface must be removed before installation of the seals. Any joint gaps, low areas, or deep imperfections must be properly filled with approved non-toxic joint filler and rendered smooth to suite the prepared surface of the joint area. When the pipe is concrete or reinforced concrete, it may be necessary to apply a thin layer of quick-setting cement mortar to the preparation area where the seal will be placed. This cement will control pipe porosity and irregularities to provide an effective leak test on the completed seal.
- 4.7 **VERIFY** that the sealing surface surrounding the joint area and the area where the “lip seals” are to be seated is free of debris and smooth. It **CAN NOT** be overemphasized the importance of good surface preparation.

- 4.8 **MARK** the locations of the lip seals on the pipe ID to clearly define the seal installation position.
- 4.9 **LUBRICATE** prepared seal area with “Ease-On Pipe Lubricant.” The lubricant shall be hand applied (using a brush) over the prepared area. Care must be taken not to acquire debris from the surrounding unprepared surfaces into the lubricant and thereby reintroducing debris to the prepared surface. The lubricant functions as an aid in fitting the seal and is not credited with pressure retention. “Ease-On Pipe Lubricant” is a brand name typically used by Miller Pipeline; however, other approved lubricant of equivalent composition is acceptable.
- 4.10 **POSITION** the WEKO-SEAL parallel to the joint gap with the pressure test valve located at approximately 3 o’clock or 9 o’clock position. The seal must be positioned accurately on the joint areas guided by the marks established in step 4.8.
- 4.11 **INSTALL** a metal radiused shim underneath the wedge area in the seal grooves for each retaining band before placement of the stainless steel bands on the seal. These shims enable radial loads to be transmitted evenly to the seal as the bands are expanded.
- 4.12 **INSTALL** the upstream and downstream stainless steel retaining bands into position by placing in designated seal grooves. If additional bands are required per project design, placement of additional retaining bands shall be placed according to Step 4.20. Since retaining bands can be of one-piece, two-piece, or three-piece construction depending on pipe diameter, a retainer clip is to be used to restrain band movement during expansion. In certain design applications, a special mechanical locking device shall be used to temporarily lock the bands before expansion. (See attached reference drawing details)
- 4.13 **POSITION** the hydraulic expander device in line with the retaining bands while ensuring that the retaining bands remain in position and do not become moved or dislodged. Care must be taken to ensure that the expander is positioned correctly on the bands.
- 4.14 **EXPAND** the stainless steel retaining bands using the hydraulic expander, holding pressure for at least two minutes. Expansion pressure range should be known before performing this operation and is available via expansion pressure chart for the designated seal size. Extreme caution should be taken to ensure that recommended expansion pressures are not exceeded, resulting in pipe and/or seal damage.
- 4.15 **INSTALL** a radiused-locking piece (wedge) in the exposed gap between the expanded band ends. The wedge size shall be selected to provide interference fit. Tap the wedge into position, locking in the compression of the seal. **RELEASE** the pressure from the hydraulic expander after wedge is secure.

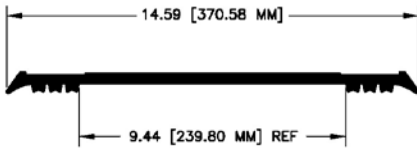
- 4.16 **PERFORM** a second expansion for each of the retaining bands a minimum of 30 minutes after the first expansion using the same pressure range as the first expansion. This allows for any seal relaxation that may occur. If required, replace wedge piece with a larger size to provide interference fit.
- 4.17 **TORQUE** the mechanical locking device to 15 inch-pounds, if required per seal design as noted in step 4.12.
- 4.18 **PERFORM** a pressure test on the seal sections after a minimum of 30 minutes has elapsed after final fitting of the seal to be tested. A restraining device called a “test band” is to be utilized when needed for standard and extra-wide seal sizes to prevent excessive ballooning.
- 4.18.1 Pressurize seal to 10 psig through the seal test valve. Apply an approved soap and water solution to the seal ends and inspect for leakage.
- 4.18.2 If the pressure test indicates leakage, determine cause and repeat step 4.7 and higher.
- 4.19 **PERFORM** a second pressure test at a lower pressure with the test band removed.
- 4.19.1 Pressurize to 5 psig through the test valve. Apply an approved soap test solution to the entire surface of the seal. This lower pressure leak test is primarily used to check for seal defects such as seal punctures.
- 4.19.2 Inspect for leakage. If the pressure test indicates leakage, remove seal and replace with new seal beginning at step 4.7 and higher.
- 4.20 **DEPRESSURIZE** seal and isolate test port. SEAL the “test valve” with a countersunk hex head completion screw using an approved thread sealing compound. Remove all installation hardware, and pressure gauges.
- 4.21 If installation of a middle-retaining band is required per design, between the upstream and downstream bands, install the middle-retaining band in accordance with steps 4.11 through 4.16. NOTE that the seals do not have a designated positioning groove for the middle-retaining band. Install the middle-retaining band upstream of the test port. Pressure testing is not required after performing this step.
- 4.22 When it is necessary to cover a wider area on the pipe than can be provided by standard or extra-wide seals, it is common and permissible to use a “sleeve” with a WEKO-SEAL at each end or overlapping of seals typically using extra-wide seals. This scenario will require prior design considerations by Miller Pipeline and the Engineering Firm/Owner.



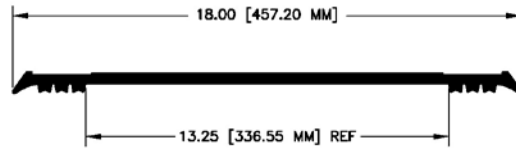
STANDAR WEKO[®] SEAL



REGULAR WEKO[®] SEAL



EXTRA-WIDE WEKO[®] SEAL



DOUBLE-WIDE WEKO[®] SEAL

WEKO-SEAL Cross Sectional Dimensions for Common Sealing Widths
Double-Wide Seals and/or Sleeves are used for additional sealing requirements

6910000009E

WEKO SEAL IS A PROPRIETARY AND PATENTED PROCESS. LICENSED EXCLUSIVELY TO MILLER PIPELINE CORPORATION.

GROUT FLUSH WHERE NECESSARY

EPDM OR NITRILE WEKO SEAL
STANDARD OR EXTRA-WIDE AS PER SPECS.

RETAINING BAND

TEST VALVE

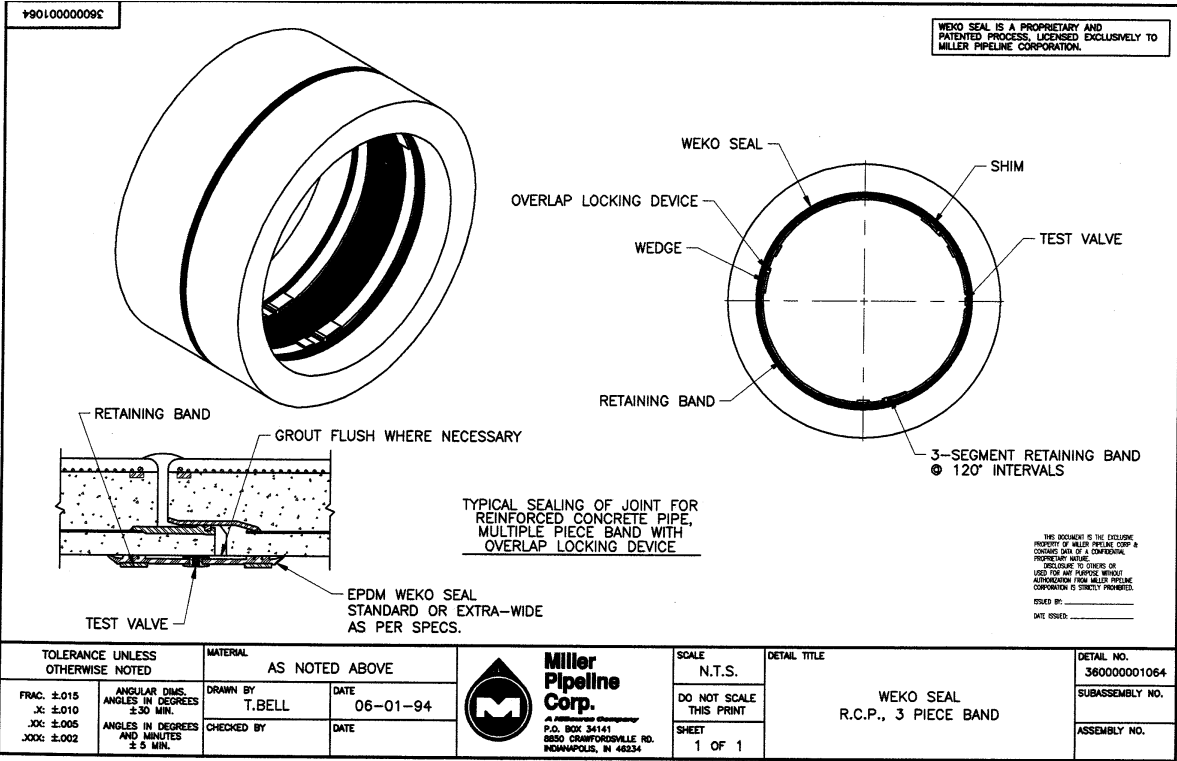
TYPICAL SEALING OF BELL JOINT
USING WEKO SEAL

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ISSUED BY: _____

DATE ISSUED: _____

TOLERANCE UNLESS OTHERWISE NOTED		MATERIAL AS NOTED ABOVE		<p>Miller Pipeline Corp. <small>A Division of</small> P.O. BOX 34141 8500 CRAWFORDVILLE RD. INDIANAPOLIS, IN 46234</p>	SCALE N.T.S.	DETAIL TITLE WEKO SEAL BELL JOINT, 1 PIECE BAND	DETAIL NO. 36000000149
FRAC: ±.015 X: ±.010 XX: ±.005 XXX: ±.002	ANGULAR DIMS. ANGLES IN DEGREES ±30 MIN. ANGLES IN DEGREES AND MINUTES ± 5 MIN.	DRAWN BY T.BELL	DATE 06-01-94		DO NOT SCALE THIS PRINT		SHEET 1 OF 1
							ASSEMBLY NO.



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UL Underwriters Laboratories Inc.

CERTIFICATE OF COMPLIANCE

CERTIFICATE NUMBER: 250795-MH18663
 ISSUE DATE: 25 July 1995

Issued to: Miller Pipeline Corp.
 8850 Crawfordville Rd.
 Indianapolis, IN 46234

Report Reference: MH18663, 18 July 1995

This is to Certify that representative samples of: AMEX-10/WEKO-SEAL

Have been investigated by Underwriters Laboratories Inc. in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety:

ANSI/NSF Standard 61: Drinking Water System Components-Health Effects

Additional Information:

Categories: Joining and Sealing Materials

Water Contact	Water Contact
Temperature	Material
Cold	Multiple

Size 14"-210"

Only those products bearing the UL Classification Marking should be considered as being covered by UL's Classification and Follow-Up Service.

The UL Classification Marking includes: the name "Underwriters Laboratories Inc."; the word "Classified"; a control number (may be alphanumeric) assigned by UL; a statement to indicate the extent of UL's evaluation of the product; and, the product category name (product identity) as indicated in the appropriate UL Directory.

LOOK FOR THE UL CLASSIFICATION MARKING ON THE PRODUCT

Engineer: *Ray Marshall* Review Engineer: *Nemphry Pitt*
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2000-44C (6/92)
UL Certificate – ANSI/NSF 61 Drinking Water Approval