



Safety Iron™

Maintenance and Inspection Procedures

Overview

Safety Iron products are well engineered and are intended to survive the harsh and demanding environment found in the oil and gas industry. However, like all oil field products, they eventually require replacement. This document serves as a guide to allow the customer to inspect and qualify Safety Iron components. Also included are recommended maintenance procedures, which will assist the customer in extending the life of the product. For all other topics on Safety Iron, see the Safety Iron Operating and Maintenance Instructions Manual or contact Weir SPM Engineering.

List of Components

The following is a list of Safety Iron components that require inspection:

1. Upper & Lower Clamps
2. Flanges
3. Seal Ring
4. Soft Seal
5. Bolts

Recommended Tools

Gloves
Protective eye wear
Vise (for securing the clamps)
Thread Wear Gauges (if necessary)
Sockets (for removing bolts)
Screwdriver (for removing retainer ring)
Wire brush
Retainer ring installation tool (if necessary)

Inspection and Maintenance

Safety Iron products are not maintenance intensive. However, common sense will go a long way towards increasing the life of the product. In general, the following procedures should be observed:

1. Do not exceed recommended flow rates. If this occurs, the rate of wear will increase dramatically and life span will be reduced.
2. If the customer chooses to exceed recommended flow rates, a more frequent inspection program will be required to determine if excessive erosion has occurred.
3. Do not over torque the bolts. This can lead to galling of the threads. See Safety Iron Operating and Maintenance Instructions Manual for additional information on calibrating air supply.
4. Conduct a quick examination of the bolts during the assembly. If a damaged bolt is detected, it can be replaced easily. This can prevent any future issues.

The following recommendations are similar to the requirements for maintaining hammer union connections. Remember - proper maintenance is not difficult and will ensure the clamps perform as intended.

1) Clamps

Safety Iron clamps are robust components and are expected to have a long life. Typical surface damage (gouges) does not affect the performance of this item, unless it is greater than the depth stated below. Focus attention on the mating contact surfaces (to ensure the clamp can be properly installed) and the internal threads. Described below is the recommend inspection procedure.

INSPECTION (Gauges Required)

- Visually inspect the exterior of the clamp for deep gouges or cracks.
 - If the gouge depth is greater than 1/8", the clamps must be discarded.
 - If the gouge depth is less than 1/8" the clamp is acceptable to use.
 - If any cracks are observed, the clamp must be discarded.
- Visually inspect mating contact surfaces on the clamp (FIGURE 1). Look for signs of impact damage that would obstruct the clamps from sliding over the flanges. If a raised surface exists due to a gouge, a grinder can be used to remove the excess material. The primary goal is to allow the mating clamp surface to freely slide over the bell of the flange.
 - If the gouge depth is greater than 1/8", the clamps must be discarded.
 - If the gouge depth is less than 1/8", the raised protrusion can be smoothed using a grinder. This will allow the product to be safely returned to use.

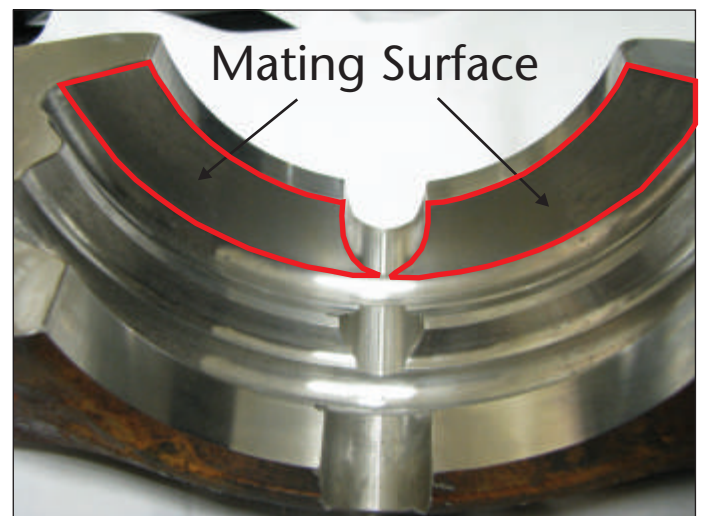


FIGURE 1- Mating surface of clamp

- Visually inspect the internal threads (only on the bottom threaded clamp) for broken or missing threads (FIGURE 2). If any obvious damage is observed, the clamp must be discarded.
- In addition to cracked or missing threads, constant use will also lead to wear of the threads. This will require inspection using the appropriate wear gauge (see TABLE 2 for list of gauges). This no-go gauge will not thread into the internal threads unless they are worn and require replacement. This will qualify wear of the threads that may be difficult to visually detect.

WEAR GAUGE INSTRUCTIONS

1. Fixture clamp within vise.
2. Select appropriate wear gauge (TABLE 2).
3. Attempt to thread the gauge into the internal threads.
4. If the full length of the gauge will thread into the clamp threads, the clamp must be discarded.
5. If the full length of the gauge will not thread onto the clamp threads, the clamp is acceptable for continued use.

Remember, the gauge will only thread into the part if the internal threads have experienced excessive wear.

MAINTENANCE

The following maintenance recommendations can increase the life of the product and prevent potential issues:

- Debris and mud can build in the clamp threads, leading to difficulty inserting the bolt. The solution is to periodically tap the threads (with the appropriate size tap) to remove any debris (TABLE 1). By removing foreign material, the life of the threads can be extended.



FIGURE 2 - Lower threaded clamp

TABLE 1: THREAD SIZES OF LOWER CLAMPS

Size	Part No	Thread Size
1.5"-15K	2P25913	7/8"~9UNC
2"-15K	2P25916	7/8"~9UNC
2"-20K	2P25916	7/8"~9UNC
3"-15K	2P25910	1"~8UNC
3"-20K	2P25232	1-1/4"~7 UNC
4"-10K	2P25922	1"~8 UNC
4"-15K	2P25232	1-1/4"~7 UNC

- Always lubricate the threads before assembling the clamps. This will ensure proper torquing, and extend the life of the clamps and bolts.
- To prevent unintentional impact damage to the clamp mating contact surfaces, Weir SPM recommends that the upper and lower clamp halves be stored by threading the two halves together (FIGURE 3).



FIGURE 3 - Safety Iron Clamps assembled for storage

2) Flanges

Flanges are an integral part of each Safety Iron flow component. Their lifespan will be primarily determined by the amount of exposure to erosion. Focus attention on the seal pocket, front face, and clamp mating surfaces. Described below are the recommended inspection procedures.

INSPECTION (No Gauges Required)

- Visually inspect the backside of the flange (FIGURE 4 & 5) for impact damage or gouges. To be a concern, the gouge must have created a protrusion of material, preventing the clamp from freely sliding over the flange.
 - o If the gouge depth is more than 1/4", the component must be discarded.
 - o If the gouge depth is less than 1/4", the raised protrusion can be smoothed using a grinder. This will allow the product to be safely returned to use.
 - o The main concern is that no "step" or obstruction exists on the flange that would let the clamp "hang-up" and not fully install.

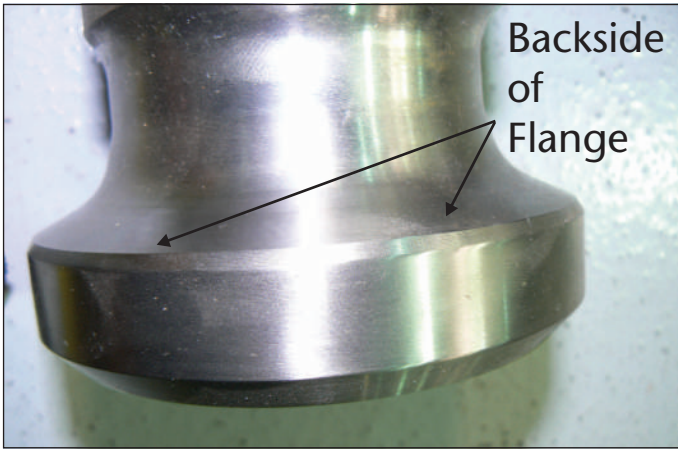


FIGURE 4 - Flange backside

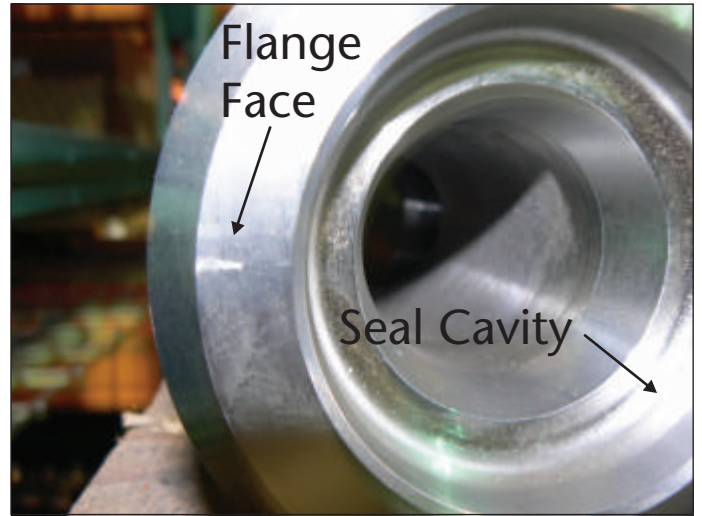


FIGURE 6 - Flange face and seal cavity



FIGURE 5 - Damaged flange backside

MAINTENANCE

The following maintenance recommendation can increase the life of the product and prevent potential issues:

- The seal cavity on the flange must be protected from excessive wear or damage. This is no different than the requirements for hammer union seal rings. Greasing the seal ring during assembly, and replacing worn soft seals is the best method to extend the life of the seal cavity.

3) Seal Rings

Seal rings are considered expendable items and will require periodic inspection. Focus attention on the seal surfaces and through-bore (FIGURE 7). Common reasons for replacement include gouges, deep scratches, and erosion damage. Described below are the recommended inspection procedures.

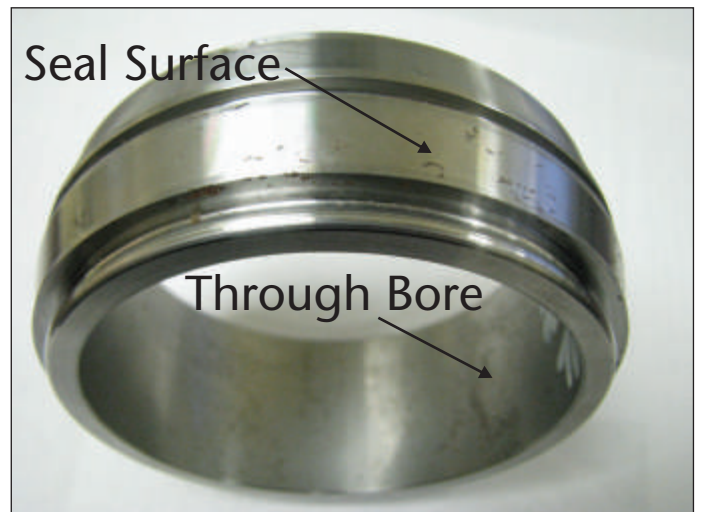


FIGURE 7 - Seal Ring

INSPECTION (No Gauges Required)

- Remove the soft seal.
- Visually inspect all seal surfaces, including under the soft seal (FIGURE 7). If any erosion, impact damage, or gouges are observed, the seal ring must be discarded.
- Visually inspect the through-bore. If washing is observed the seal ring must be discarded.

- Visually inspect the front face of the flange (FIGURE 6) for impact damage or gouges. To be a concern, the gouge must have created a protrusion, which would prevent the two mating flanges from being brought completely together.
 - o If the gouge depth is greater than 1/4", the item must be discarded.
 - o If the gouge depth is less than 1/4", the raised protrusion can be smoothed using a grinder. This will allow the product to be safely returned to use.
- Visually inspect the seal cavity for damage (FIGURE 6). This would include erosion, gouging, or deep scratches. If any damage is observed, the component must be discarded.

4) Soft Seals

Soft seals are considered expendable items (FIGURE 8) and should be inspected during each assembly of the iron. If the seal appears questionable, it should be replaced. The maintenance for soft seals will be similar to hammer union seals. Described below are the recommended inspection procedures.

INSPECTION (No gauges required)

Look for signs of damage such as tears, extrusion, or washing. If any damage is observed, the seal should be discarded.



FIGURE 8 - Soft Seal

5) Bolts

Safety Iron bolts are designed for robust performance. They include features such as cross-resistant thread design, and plated surfaces. However, like all threaded connections, they must be treated with care and respect. Potential bolt issues include the following:

1. Galling of bolt threads. This is due to over torquing or insufficient lubricant
2. Crossing of threads. This is prevented by hand rotating the bolts one (1) full turn before applying pneumatic tool.
3. Impact damage to the threads. This is caused by careless behavior or improper storage (FIGURE 9).

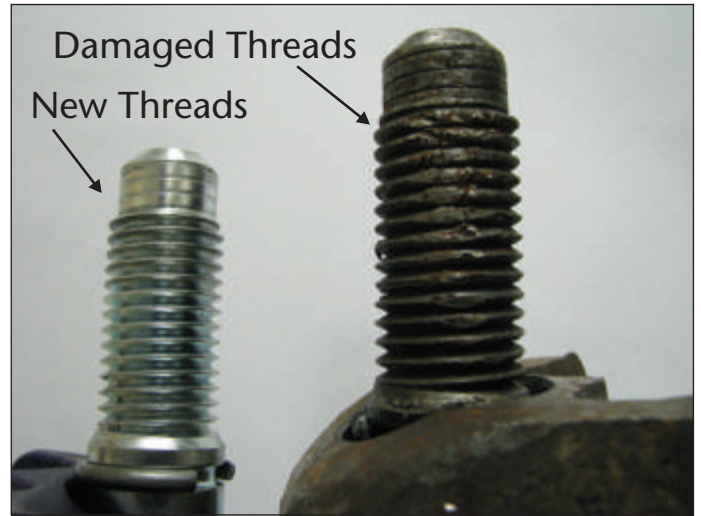


FIGURE 9 - Damaged and good bolts

TABLE 2: LISTING OF GAUGE PART NUMBERS

SIZE	RETAINER RING REMOVAL TOOL	CLAMP THREAD WEAR GAUGES	BOLT THREAD WEAR GAUGES
2"-15K	2A27495	2A27498	2A27499
3"-15K	2A27494	2A27500	2A27501
3"-20K	2A27497	2A27502	2A27503
4"-10K	2A27494	2A27494	2A27501
4"-15K	2A27497	2A27497	2A27503

With proper care, Safety Iron bolts can have a reasonable lifespan. If the bolts do become worn, they can easily be replaced using the Weir SPM installation tool (see maintenance section below for instruction on installing captive bolts). Described below are the recommended inspection procedures.

INSPECTION (Gauges required)

- Visually inspect bolts for damaged threads. Damage includes unintentional impacts, galled threads, and missing threads. If any damaged threads are observed, the bolt must be discarded.
- In addition to obvious thread damage, it is possible for the threads to become worn due to daily use. This type of wear is more difficult to detect. The most likely sign would be increased "looseness" in the makeup. Use a Weir SPM wear gauge to determine if the threads are worn (see instructions below). The no-go gauge should not thread on the bolt. If this occurs, the bolt must be replaced.
- Visually inspect that the retainer ring holds the bolt captive. This feature is intended for convenience and prevents the bolts from being separated from the upper clamp halves. If the bolt is not held captive, the retainer ring should be replaced. This requires the use of the Weir SPM installation tool. See maintenance section below for instructions on replacing the retainer ring.

WEAR GAUGE INSTRUCTIONS

1. Fixture bolt by placing hex head within vise.
2. Select appropriate wear gauge (TABLE 2).
3. Attempt to thread the gauge onto the bolt threads.
4. If the full length of the gauge will thread onto the external threads, the bolt must be discarded.
5. If the full length of the gauge will not thread onto the external threads, the bolt is acceptable for continued use.

Remember, the gauge will only thread onto the part if the threads have experienced excessive wear.

MAINTENANCE

The following maintenance recommendations can increase the life of the product and prevent potential issues:

- Always lubricate bolt threads before assembly. This is important to prevent galling, increase the lifespan, and ensure the bolts have the proper torque. Recommended bolt torque is based on using lubricated bolts. A "dry" assembly will result in the actual preload being less than is intended.
- Recommended lubricants for bolt threads include general-purpose grease or anti-seize. The use of motor oil as a lubricant is common in the field. While we do not recommend this as the "ideal" lubricant, we do acknowledge that it meets our minimum requirements.
- If bolts are difficult to thread into clamp, they may require cleaning. This is best accomplished by using a wire brush. Drill mounted wire brushes are acceptable if care is taken not to damage the threads.
- To prevent damage to the threads during storage, the upper and lower clamps should be threaded together.

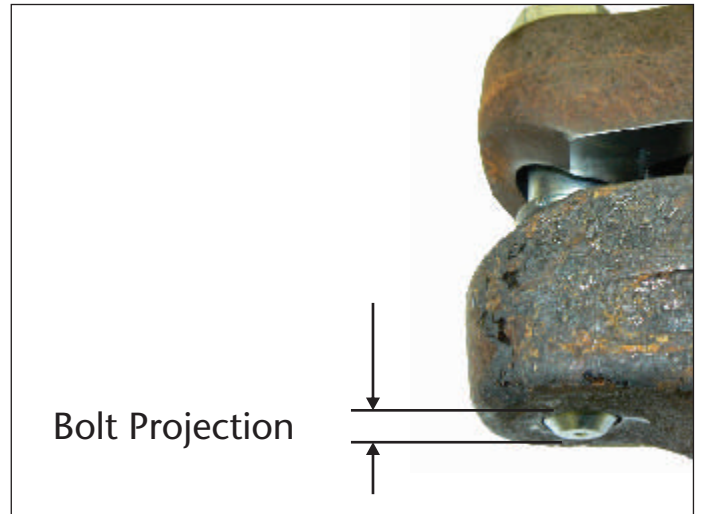
WARNING!

DAMAGED BOLT THREADS CAN LEAD TO FALSE TORQUE READINGS. THIS CAN MISLEAD THE TECHNICIAN TO BELIEVE THE BOLTS ARE PROPERLY INSTALLED. ALWAYS USE COMMON SENSE WHEN ASSEMBLING SAFETY IRON - IF THE BOLTS DON'T APPEAR TO BE FULLY ENGAGED THEN THEY PROBABLY ARE NOT!

IT IS CRITICAL THAT A FINAL INSPECTION BE PERFORMED ON THE IRON AFTER COMPLETION OF THE ASSEMBLY. THE RECOMMENDED INSPECTION IS FAST AND EASY AND CAN BE ACCOMPLISHED IN MINUTES:

1. Place hands on back side of threaded clamp and locate the end of the bolt (FIGURE 10). Use your fingers to feel the bolt end. It should be approximately flush with the backside of the threaded clamp. If the end of the bolt is recessed more than 1/4" into the threaded opening, the bolt may not be fully tightened.
2. Repeat for each connection.
3. See *Safety Iron Operating and Maintenance Video* for additional information.

This process will ensure that the technician locates any bolts which were not fully tightened. This could be due to damaged threads, or carelessness of the technician.



REMEMBER - The clamps cannot be separated due to operating pressures unless the bolts are not fully threaded into the lower clamps.

REFERENCES

Safety Iron Operating and Maintenance Instructions Manual

Safety Iron Operating and Maintenance Training Video



FIGURE 14

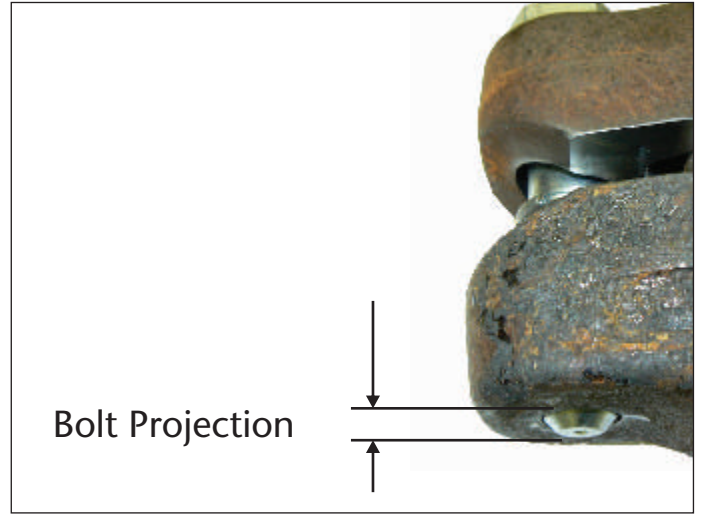


FIGURE 15

WARNING!

DAMAGED BOLT THREADS CAN LEAD TO FALSE TORQUE READINGS. THIS CAN MISLEAD THE TECHNICIAN TO BELIEVE THE BOLTS ARE PROPERLY INSTALLED. ALWAYS USE COMMON SENSE WHEN ASSEMBLING SAFETY IRON - IF THE BOLTS DON'T APPEAR TO BE FULLY ENGAGED THEN THEY PROBABLY ARE NOT!

IT IS CRITICAL THAT A FINAL INSPECTION BE PERFORMED ON THE IRON AFTER COMPLETION OF THE ASSEMBLY. THE RECOMMENDED INSPECTION IS FAST AND EASY, AND CAN BE ACCOMPLISHED IN MINUTES:

1. Place hands on back side of threaded clamp and locate the end of the bolt (FIGURE 15). Use your fingers to feel the bolt end. It should be approximately flush with the backside of the threaded clamp. If the end of the bolt is recessed more than 1/4" into the threaded opening, the bolt may not be fully tightened.
2. Repeat for each connection.
3. See *Safety Iron Operating and Maintenance Video* for additional information.

This process will ensure that the technician locates any bolts which were not fully tightened. This could be due to damaged threads, or carelessness of the technician.

REMEMBER - The clamps cannot be separated due to operating pressures unless the bolts are not fully threaded into the lower clamps.

REFERENCES

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Safety Iron Operating and Maintenance Training Video

COMPLETE CLAMP KITS

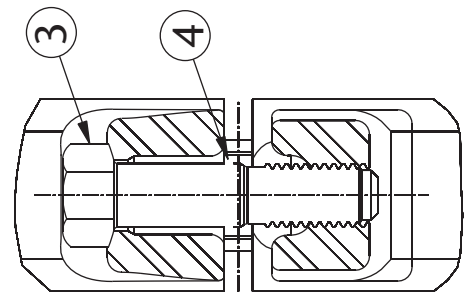
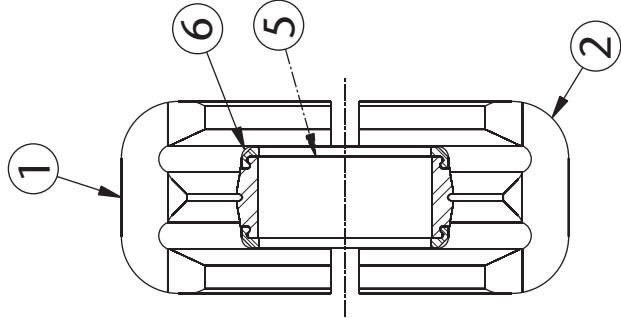
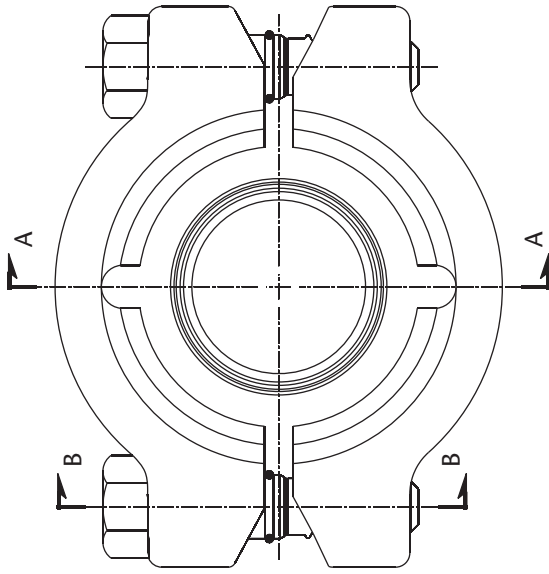
SIZE	KIT NO.	'A'	'B'	'C'	'D'	'E'	'F'
1.5"-15K	2A25930	2P25912	2P25913	2P25242	2P25243	2P25871	2P25872
2"-15K	2A25919	2P25918	2P25916	2P25242	2P25243	2P25899	2P25250
2"-20K	2A26078	2P25918	2P25916	2P25242	2P25243	2P26080	2P25408
3"-15K	2A25917	2P25904	2P25910	2P25247	2P25248	2P25903	2P25252
3"-20K	2A25405	2P24728	2P25232	2P25233	2P25234	2P25903	2P25252
4"-10K	2A25927	2P25921	2P25922	2P25247	2P25248	2P25874	2P25926
4"-15K	2A25402	2P24728	2P25232	2P25233	2P25234	2P24735	2P24736

CLAMP ONLY KITS

SIZE	KIT NO.	'A'	'B'	'C'	'D'
1.5"-15K	2A25680	2P25912	2P25913	2P25242	2P25243
2"-15K	2A25681	2P25918	2P25916	2P25242	2P25243
2"-20K	2A25682	2P25918	2P25916	2P25242	2P25243
3"-15K	2A25929	2P25904	2P25910	2P25247	2P25248
3"-20K	2A26021	2P24728	2P25232	2P25233	2P25234
4"-10K	2A26022	2P25921	2P25922	2P25247	2P25248
4"-15K	2A25435	2P24728	2P25232	2P25233	2P25234

SEAL RING KITS

SIZE	KIT NO.	'E'	'F'
1.5"-15K	2A26023	2P25871	2P25872
2"-15K	2A26024	2P25899	2P25250
2"-20K	2A26025	2P26080	2P25408
3"-15K	2A26026	2P25903	2P25252
3"-20K	2A26027	2P25903	2P25252
4"-10K	2A26028	2P25874	2P25926
4"-15K	2A26029	2P24735	2P24736



ITEM	QTY	PART NO	DESCRIPTION
6	2	"E"	SOFTSEAL
5	1	"E"	SEALRING
4	2	"D"	BOLTRETAINER
3	2	"C"	BOLT
2	1	"B"	CLAMP HALF-THREADED
1	1	"A"	CLAMP HALF-PLAIN

DO NOT SCALE DRAWING

UNLESS OTHERWISE NOTED
DIMENSIONS ARE IN INCHES

linear tol: fractional: .XX, .XXX, .XXX
Angular tol: +.005, +.30

All diameters concentric to 0.10 unless otherwise noted
12 surface roughness all machined surfaces

SPM 7601 WYATT DRIVE
FT WORTH TEXAS 76108-2587

Scale: NONE
Date: 12/01/05

Drawn by: JED
Approved: JDC

TITLE KIT LISTING
TITLE 2
SAFETY IRON-ALL SIZES

Material: MATERIAL
Drawing No: 2L25679

REV	DESCRIPTION	DATE	BY
R2	SEE ECN#4532		
R1	SEE ECN#4535		

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