EBAA IRON Connections™
TECHNICAL DATA FOR THE WATER & WASTEWATER PROFESSIONAL

A Brief Description of the Background and Operation of the MEGALUG® System of Restraint

The mechanical joint is one of the most versatile joints available for the water and wastewater industry. It was first patented in 1921 by W. D. Moore and the joint was standardized in the early 40's. The versatility of the joint is born out by its longevity. Since the time of its standardization through AWWA, the basic joint has not changed and still finds considerable use. This is especially true of fittings, valves, hydrants, and the like.

One thing that has changed and developed over the years is restraint for the mechanical joint. As the joint became popular, people searched for ways to restrain the joint and simplify the pipeline construction process. One style of restraint came onto the scene and has endured to this day. That is the set screw retainer gland. This product, unlike welded or grooved restraint, permitted the pipe to be cut and fabricated in the field. This feature is very important for pipeline configurations, above and below ground that must be changed to conform to existing conditions. However, the set screw retainer gland does have its drawbacks. The installation can be involved and complicated and there are significant limits to the performance of set screw restraint in larger sizes.

The MEGALUG system of restraint for the mechanical joint takes these design needs and product deficiencies into account to provide the best field adaptable restraint available.

How It Works

Set screw glands implement a very simple technique for restraint. By virtue of torque, the tip of the screw cuts a "pocket" in the outer surface of the pipe wall. The set screw remains in place and the pocket and screw tips are in shear when the thrust bears on the joint. When the shear load on this interface exceeds the capacity of the pipeline material, the restraint begins to fail.

On the other hand, the wedge style MEGALUG design reacts to the amount of force acting on the joint. When each wedge is set, the wedge teeth penetrate the pipe outer surface, and the wedge does not move on the pipe. There is very little change in this interface until the wedge movement begins inside the pocket of the main casting. Once the wedge starts moving, the formation of the buttress begins. This "dam" of material (the wedge impression) is cold formed as the wedging action continues.

Typically, the depth of pipe wall penetration at around 2500 pounds force per wedge (200 psi on a six inch and 150 psi on a twelve inch) is 0.01". At around 4400 pounds force per wedge (350 psi on a six inch and 250 psi on a twelve inch) the total penetration is 0.03". Finally, at roughly twice that force the penetration is around 0.05". At these high pressures, there is no affect on the design thickness of ductile iron pipe made according to AWWA C150. The lack of damage to the cement lining clearly indicates that the thrust load is primarily longitudinal. Underwriters Laboratories listing for the restraint requires a pipe damage test on the absolute minimum pipe wall thickness available. The MEGALUG product has been subjected to this and passed easily.

If the force or pressure acting on the joint is released, the wedge moves back to near its original position. This engages the Reserve Controlled Movement or "RCM". The wedge is then ready for another round. When the wedge is in the back of the pocket at the maximum pressure or load, the wedge and buttress are in shear. The maximum longitudinal movement is about 0.3 inch through the twenty-four inch size and 0.4 inch for thirty-six through forty-eight inch. The RCM is available even with severe cyclic loads. This has been tested to very high pressure differentials and the wedge impressions look the same as if a single test had be performed.

Because the surface of ductile iron pipe is relatively hard, it is important that the wedge be designed so that it is able to grab the pipe without complicated adjustments and torquing. The MEGALUG wedge teeth are shaped to provide for maximum gripping during initial installation. If an attempt is made to engage a great amount of tooth area during initial installation the grip becomes very reliant upon stringent tightening and torque requirements. The MEGALUG wedge tooth design has proven successful for over twenty years and the physical principles on which it is based remain.

In a dead end hydrostatic test, the movement of the wedge occurs at the approximate pressures listed in the following table.

Variations

The discussion to this point has concentrated on the solid ring, mechanical joint restraint version of the 1100 Series. There are several variations available that increase the versatility of this product.

The standard mechanical joint restraint also comes split for the retrofit of existing mechanical joints. This split, the 1100SD, can be used in place of, or directly behind, the plain gland. The rated pressures for this modification are the same as or slightly less than the solid ring version depending on the size.

The split concept is taken a step further with a split harness for restraining existing push on ductile iron pipe bells. This product incorporates an adaptation of the 1100SD on each side of the bell with rods to connect the two. A single adaptation, 1100SDB, can be used at any location on a ductile iron pipe to serve as an anchoring point for rodding back to a structure or serving as a stop collar for a concrete dead man.

Assembly

The installation of the series 1100 MEGALUG restraint requires no special tools or procedures. The t-bolts on the mechanical joint are simply tightened according to the recommendations of the AWWA C-600, "Installation of Ductile-Iron Water Mains and Their Appurtenances". In a nutshell, those requirements are to (1) make sure that the components of the joint are clean and the gasket lubricated, (2) assemble the components, then (3) tighten the t-bolts to their recommended torque. The only additional step required for the MEGALUG restraint is to tighten the wedges with the torque limiting nuts. The complete assembly procedures are included in our product literature, on our shipping tags, and in video form. Clips hold the wedges in place if the restraint has to be removed and reassembled using the 5/8" hex heads provided after the torque limiting nuts twist off.

Conclusion

The MEGALUG system has the superior holding capability of a positive locking restraint combined with simple installation techniques and field adaptability.

Nominal Pipe Size		Rated Pressure		Wedge Movement		Maximum Movement		Maximum Load	
(in)	Area(in^2)	(psi)	(lbf)	(psi)	(lbf)	(psi)	(lbf)	(psi)	(lbf)
4	18.1	350	6,335	460	8,326	520	9,412	1,500	27,150
6	37.4	350	13,090	370	13,838	390	14,586	1,200	44,880
8	64.3	350	22,505	260	16,718	310	19,933	1,000	64,300
10	96.8	350	33,880	260	25,168	310	30,008	1,000	96,800
12	136.9	350	47,915	250	34,225	300	41,070	900	123,210
14	183.9	350	64,365	230	42,297	280	51,492	850	156,315
16	237.8	350	83,230	210	49,938	260	61,828	850	202,130
18	298.6	250	74,650	170	50,762	310	92,566	700	209,020
20	366.4	250	91,600	160	58,624	290	106,256	650	238,160
24	522.8	250	130,700	150	78,420	310	162,068	650	339,820
30	804.3	250	201,075					500	402,150
36	1,152.1	250	288,025					500	576,050
42	1,555.3	250	388,825					500	777,650
48	2,026.8	250	506,700					500	1,013,400

