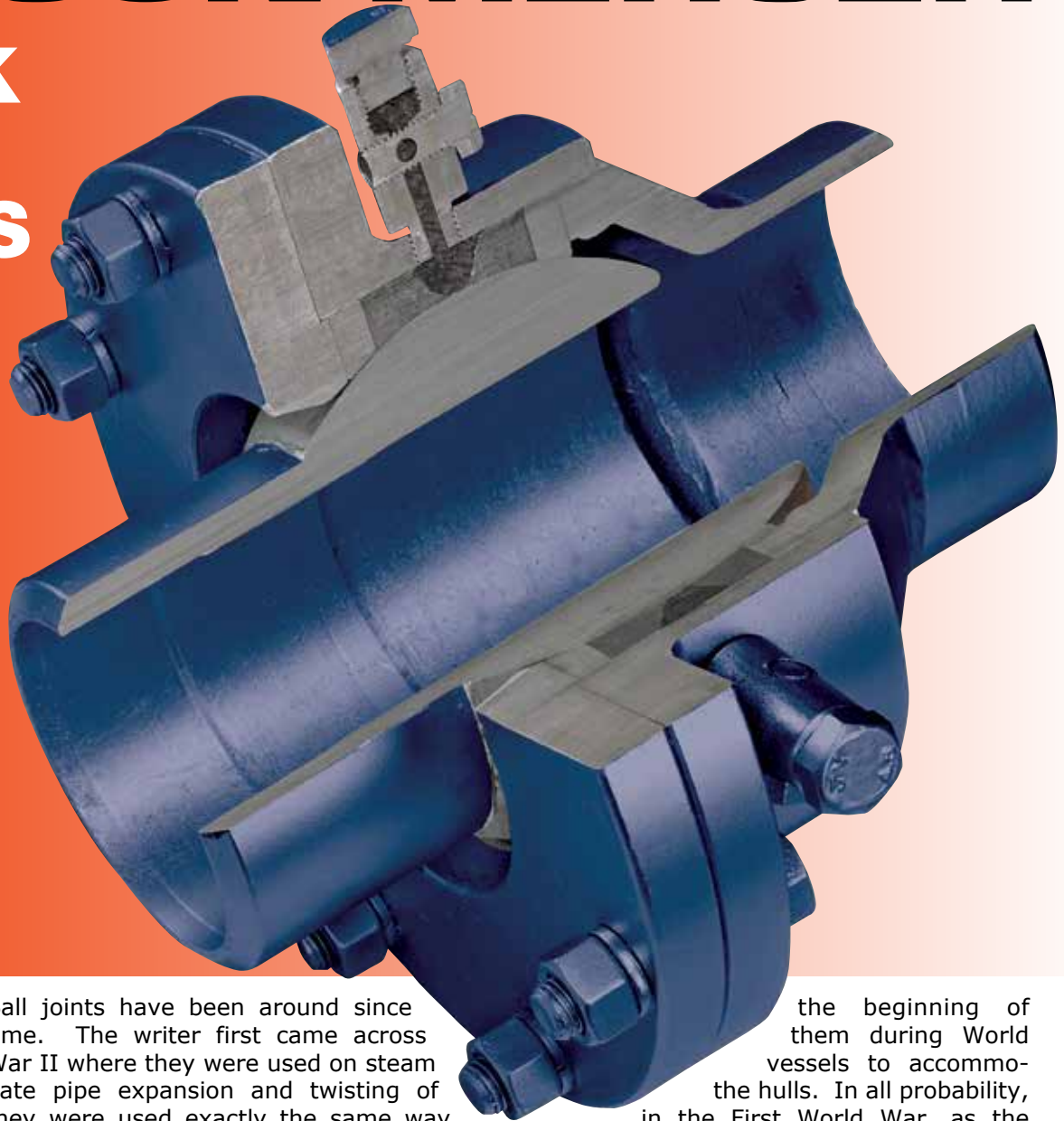


MASON-MERCER

STOCK BALL JOINTS



Ball joints have been around since time. The writer first came across them during World War II where they were used on steam vessels to accommodate pipe expansion and twisting of the hulls. In all probability, they were used exactly the same way in the First World War, as the Liberty Ships of World War II were copies of the same vessels.

the beginning of them during World vessels to accommo- the hulls. In all probability, in the First World War, as the

All in all, that is about a 100 year history with little difference in design except for the use of better grade materials and improved seals. While thin walled material like Stainless Steel hoses or the many variations of Stainless Steel expansion joints have very high safety factors, there is comfort in knowing you are using a zero thrust product where no component has a thickness less than the piping itself. One of our overseas reps, in a country where sabotage was common, commented "They are quite resistant to rifle fire as well."

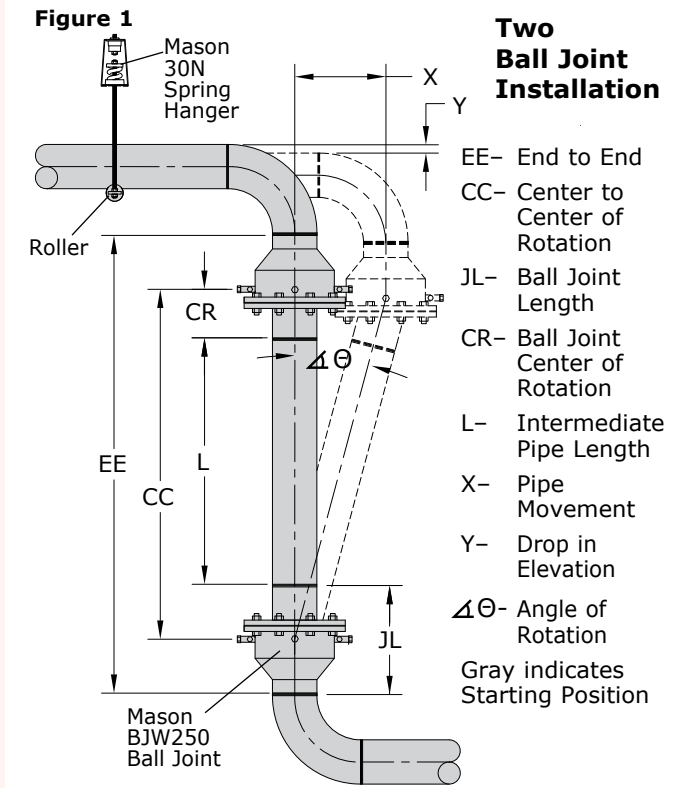
We were first exposed to the need for ball joints where thermal expansion design centered around the use of high pressure steam for heating. There is one huge steam generating station in lower New York that continues to supply steam for heating in New York City. Any building owner that purchases this high pressure supply steam must engineer all their high pressure inlet piping to Con Edison's (the steam supplier's) satisfaction. The use of ball joints to handle thermal movement is a necessity as space is tight and leaves no room for pipe loops or offsets.

We not only sell our ball joints, but we engineer the systems as well, should there be no specifications or if specifications call for design by vendor.

We look forward to working with you.

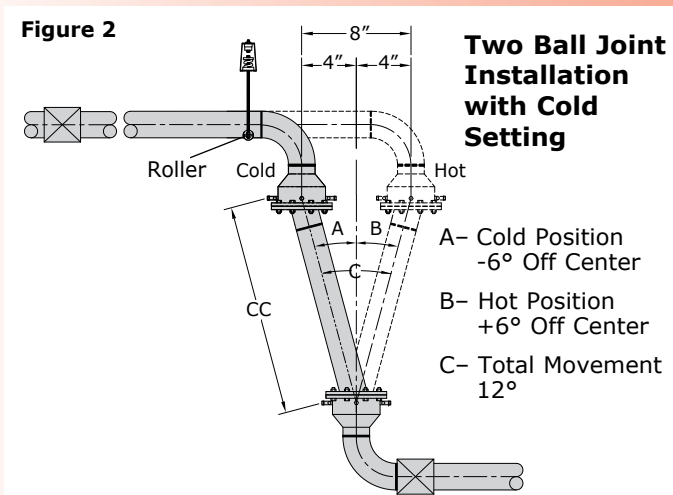
TWO BALL JOINTS

When ball joints are installed at each end of a pipe offset (Fig. 1), the system can accommodate much larger movements with much lower anchorage requirements than solid pipe in the same configuration.



COLD SETTING

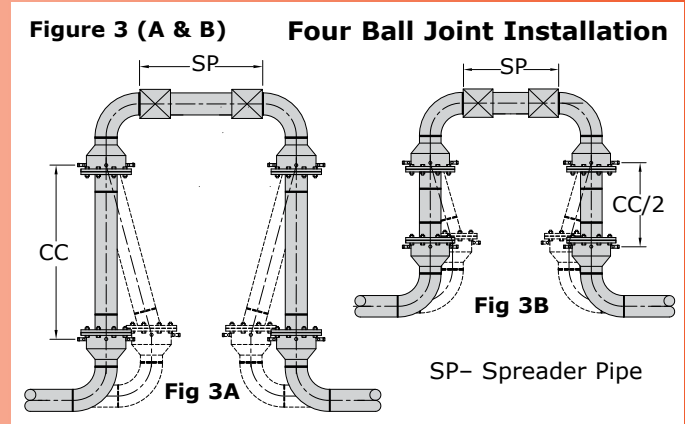
One way to increase allowable motion is to start out with the assembly pre-set all the way to the position when the pipe is cold (Fig. 2). Assuming the total expansion from Cold (Ambient Temperature) to Hot is 8 inches, you could set the pipe line 4 inches off center and design for a 4" rather than an 8" movement leg. The piping is preset 6° off center to 6° past center. Maximum rated movement is 7.5° off center, so 6° provides a safety factor.



While the method is perfectly valid, steamfitters are accustomed to working "Plumb" and the "Cold Set" instruction can be missed. The method is excellent but supervision becomes essential and the designer must decide whether to take the risk.

FOUR BALL JOINTS

In many cases any offset is undesirable, so four ball joints are used in a loop (Fig. 3A). Using the same dimension "CC" in both legs, you can accommodate twice the motion. Reducing the centers 50% would accommodate the same two joint motion (Fig. 1) with smaller offset and conserve space as well (Fig. 3B).



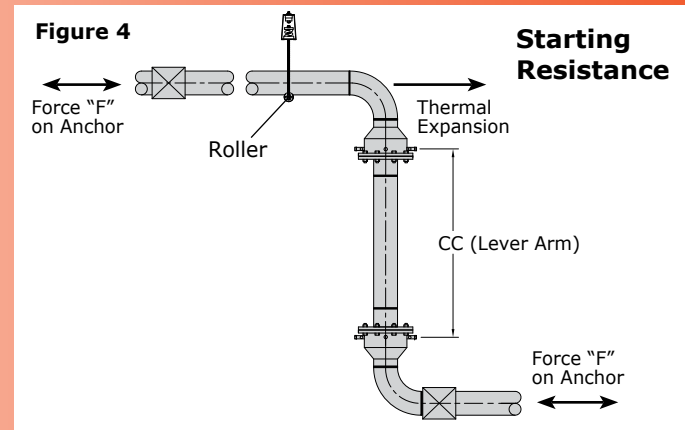
DROP IN ELEVATION "Y"

Ball joint movement reduces distance between parallel piping as shown by "Y" (Figure 1). This dimension is significant because if the offset is vertical, the adjacent pipe support could pull out. Therefore a Mason 30N spring hanger with a minimum deflection of 4 times "Y" should be installed at the first support and the second and third locations studied.

STARTING RESISTANCE

Ball joints do not generate any pressure thrust. However, there is an initial force required to start motion that controls anchorage.

The force "F" applied to the pipe anchors is directly related to the distance between Ball Joint Centers "CC". (Figure 4). Force "F" diminishes with longer lever arms needed for larger movements. Four joint loops have shorter levers for the same movement, so forces increase (Table 4).



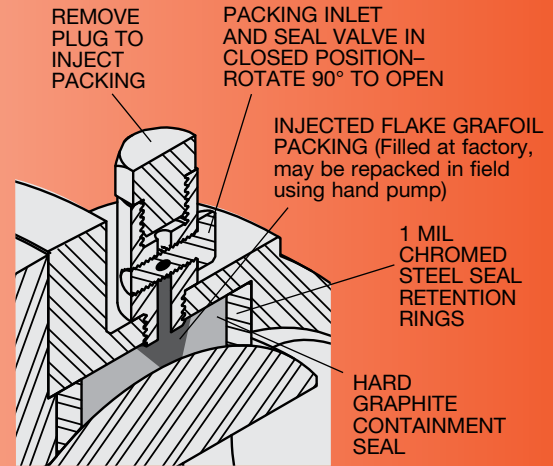
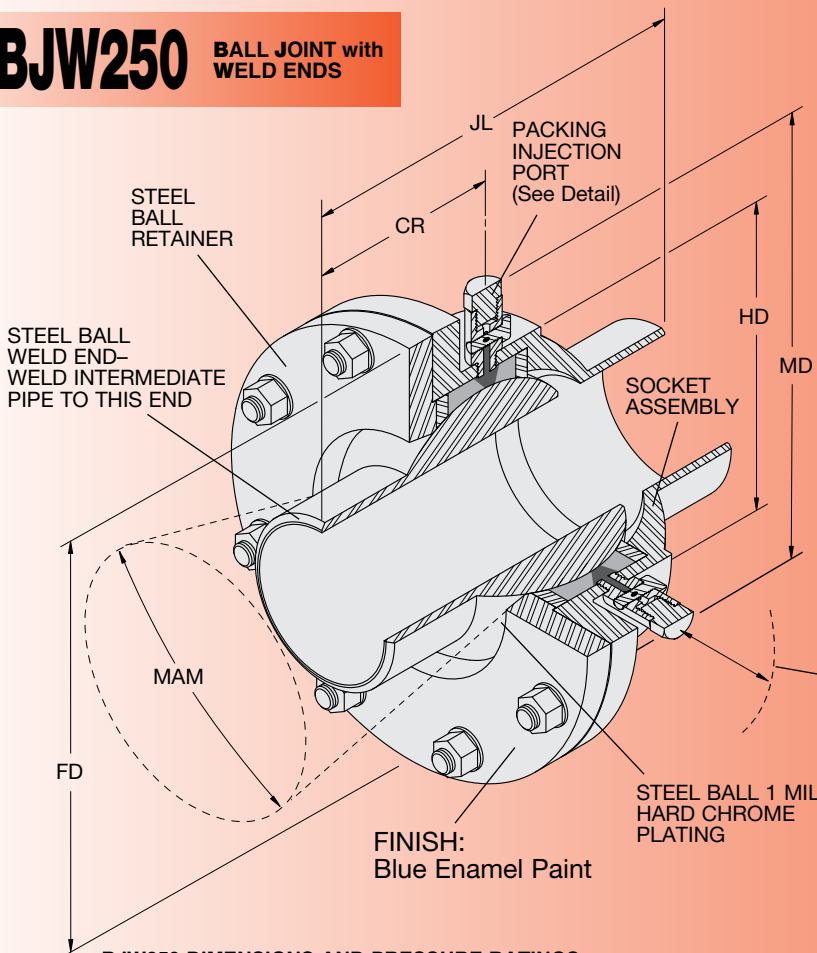
USING SELECTION TABLES

The following tables provide rounded values for easy selection. For the sake of simplicity, Ball Joint Centers "CC" are in 6" increments in Table 1 and 3" in Table 2. If space is tight, interpolate between columns. Calculations based on Table 5 may save even more space.

The next page provides examples of how to use the tables with the installations previously discussed.

BJW250

BALL JOINT with WELD ENDS



SEAL AND PACKING DETAIL

Maintain 4" minimum clearance around MD to allow for repacking. Packing can be injected under full line pressure when required. Packing to be Flake Grafoil.

BJW250 DIMENSIONS AND PRESSURE RATINGS

Type & Size	Pipe Size (inches)	JL Joint Length (inches)	CR Center of Rotation (inches)	FD Flange Diameter (inches)	HD Hub Diameter (inches)	MD Max. Diameter (inches)	MAM Max. Angular Movement (degrees)	Maximum Pressure @480°F (psi)	Starting Resistance Torque (ft-lbs)	Number of Ports	Ship Weight (lbs)
BJW250-2	2	7	4	-	5 1/4	9 1/2	30	250	200	2	16
BJW250-2 1/2	2 1/2	7 7/8	4 1/8	-	6	10 1/4	15	250	230	2	23
BJW250-3	3	8 1/2	4 3/8	-	6 1/2	10 3/4	15	250	320	2	26
BJW250-4	4	10 1/2	5	10 7/8	7 7/8	12 1/8	15	250	600	4	72
BJW250-5	5	10 5/8	5 1/8	12	9	13 1/4	15	250	1000	4	80
BJW250-6	6	11 7/8	5 5/8	13 1/4	10 1/2	14 3/4	15	250	2000	5	113
BJW250-8	8	14 3/8	7	16	13	17 1/4	15	250	3300	6	189
BJW250-10	10	16	7 5/8	19 3/8	16	20 1/4	15	250	6000	7	280
BJW250-12	12	18 1/8	9 1/2	22	18 1/2	22 3/4	15	250	7500	8	361
BJW250-14	14	19 1/4	10 1/2	23 5/8	20	24 1/4	15	250	11000	9	443

BALL JOINT SPECIFICATION:

Steel Ball Joints shall have weld ends or fixed and floating flanges. The thrust free, ball and socket arrangement shall allow 360° of intermittent rotation and a minimum rocking motion of ± 7.5 degrees. Seals are guaranteed by the high pressure injection of graphite packing in a cavity between reinforced hard graphite and steel rings.

The ball and steel seal retention rings shall be plated with a minimum 1 mil thickness of crack free hard chrome. The socket must incorporate an adequate number of packing cylinders for uniform distribution of the graphite seal. All cylinders must incorporate a valve to prevent blowback should pumping additional sealing material become necessary while under full line pressure.

Minimum ratings are 250 psi (17 Bar) @ 480°F (250°C).

Certifications must include:

1. Either manufacturer's published information or calculations by a P.E. to verify length of spool pieces and the distance between centers of ball joints for the motion with a reasonable safety factor.

2. The friction force at the start of motion to be resisted by the anchors.

Should the consulting firm prefer to indicate location of anchors and ball joints as preliminary and leave final selections to job site conditions, the manufacturer must have a P.E. on staff with a minimum of 5 years piping design experience to submit final details to allow motion as well as the force on the anchors to overcome starting friction.

Ball Joints shall be weld end **BJW** or Flanged **BJF** as manufactured by Mason Industries, Inc.



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