

# THRUST AREAS & FORCES

## THRUST IN PIPING SYSTEMS . . .

1. Suitable restraint must be designed into the pipe anchoring and guiding arrangement of a piping system utilizing Expansion Joints.
2. Thrust area, working pressure, deflection force and resistance to sliding friction are all influencing factors which determine the amount of anchoring to be provided.

## BELLOWS DIMENSIONAL DATA

PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.	PIPE SIZE IN INCHES	MAX. BELLOWS O.D. IN INCHES	THRUST AREA SQ. IN.
2	3¼	5.5	12	14½	135
2½	3¾	7.5	14	16½	181
3	4¾	10.5	16	18½	233
3½	4¾	13.5	18	20½	289
4	5¾	17	20	22½	347
5	6½	27	24	26½	492
6	7¾	37	30	32½	755
8	9¾	62	36	38½	1070
10	12	97	42	44½	1460
			48	50½	1885

3. When an Expansion Joint is pressurized an internal thrust force is created. Force is developed due to the internal pressure acting on the effective cross section area of the bellows. This area is called the thrust area, and is tabulated above.
4. In order to evaluate the loads upon piping, supports, or equipment, it is necessary to determine the forces required to move an Expansion Joint. The catalog contains force data for the standard units offered. This data is expressed as the force required to move a bellows unit 1" axially. Lateral force data is also tabulated.
5. In a piping system containing Expansion Joints, it is sometimes impractical to use main anchors to absorb the pressure thrust or to transmit this force to the connected equipment. In such cases, the proper use of tied, hinged or gimbal Expansion Joints can solve the problem. The use of such Expansion Joints require that the connections between the pipe and the tie rods, hinges or gimbals be properly designed to absorb the forces imposed by the pressure in the piping system.

The thrust absorbing members of an Expansion Joint (tie rods, hinges, gimbals and attaching structures) are normally designed to restrain only the pressure thrust developed within the piping system and the force required to move the bellows.

If other forces are considered in the Expansion Joint design, this fact, along with information regarding the magnitude and direction of these forces, must be provided to the Expansion Joint designer. These additional forces to be considered include the following:

- a. Unsupported weight of connecting pipe and insulation between a pair of bellows.
- b. Weight of contained fluid under operation and/or test conditions.
- c. Wind, earthquake and/or impact loads.

The effects of temperature and flow conditions must be accounted for in conjunction with the above forces and loads.