



# Engineering Standard



## MATERIAL HANDLING SLINGS

15.1  
1991 JULY  
PAGE 1

### 1. SCOPE

This Standard provides the specifications to be used in ordering, using, and maintaining chain, wire rope, and synthetic webbing slings. The present Standards are being replaced effective the date of this standard:

- o 15.1.1 Chain Slings dated July, 1962.
- o 15.1.2 Wire Rope Slings dated June, 1981.
- o 15.1.3 Synthetic Webbing Slings of Nylon and Polyester dated January, 1973

Use ANSI/ASME B30.9 Slings, as the new reference for all specifications and recommendations for application. The current publication and/or addendum will be used unless otherwise indicated.

PLAINTIFF'S  
EXHIBIT  
AL-1329

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SUPERSEDES 1988-DECEMBER

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# Engineering Standard



## EXCESS AIR FLOW SAFETY VALVES

16.4.1  
1988 APRIL  
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### 1. SCOPE

This Standard covers the use, selection and location of excess air flow safety valves, intended to shut off air flow upon failure of a hose or fitting carrying compressed air.

### 2. GENERAL

- Note that:
  - 1) Serious personal injury can result from compressed air hoses whipping, as might be caused by rupture, accidental cutting, or being suddenly disconnected.
  - 2) Federal Regulations require that compressed air hose greater than 1/2 inch I.D., be fitted with a safety device at the source of supply or branch line to reduce pressure in the event of hose failure. This includes placement at air line take offs used with air-operated hand tools and portable hoses, but not necessarily every column air drop or outlet and excludes lines piped directly to stationary equipment.
- Reference Figure 1, below, which shows a typical valve in cross section, noting that:
  - 1) During normal operation, the poppet is held in position by the retaining ring and spring pressure, as shown in "A".
  - 2) Upon rupture or other failure, the surge of air causes the poppet to close, as shown in "B".
  - 3) The poppet will remain closed so long as upstream pressure exceeds downstream pressure.
  - 4) A small amount of air bleeds through the closed valve, to equalize pressure during repairs and facilitate the valve opening automatically.

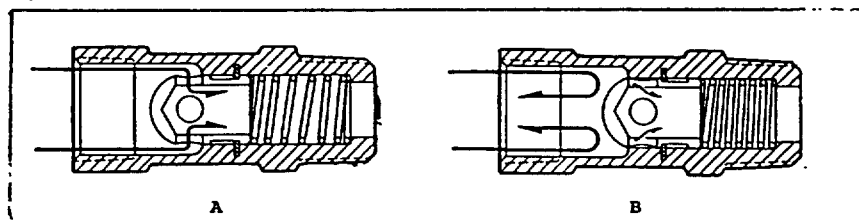


FIGURE 1

### 3. SELECTION

- Reference Appendix, Table 1, for a partial listing of acceptable valve manufacturers, valve sizes and ratings, noting that these are not intended as recommendations.
- Note that:
  - 1) Flow rates in an air hose depend on compressor output (volume and pressure), line and hose diameter and length, pressure drop through the fittings and capacity of the pneumatic power tool.
  - 2) Shut-off flow rates for valves vary with manufacturer.

SUPERSEDES 1985 APRIL

468346 1525

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# Engineering Standard



## EXCESS AIR FLOW SAFETY VALVES

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- o Proper valve functioning depends on selecting a valve with a shut-off flow rate somewhat higher than the normal flow rate for the system.
- o Check flow rate using a flow meter or using the following procedure:
  - 1) Install an excess air flow safety valve based on estimated required flow, and
  - 2) Install the highest capacity air tool to be used on the line.
  - 3) Turn on the air supply and assure that the tool works properly. If not, install an excess flow rate valve with a higher shut-off flow rate.
  - 4) Substitute a high capacity shut-off valve for the air tool.
  - 5) Grasp the closed shut-off valve and open it fully. The safety valve must close. If not, an excess flow rate valve with a lower closing flow rate must be used.

**NOTE:** Installation of a safety flow valve without verification of its suitability for the system may not comply with the intent of OSHA regulations.

### 4. LOCATION

- o Locate safety valves as shown in Figure 2, below, noting that in the middle figure:
  - 1) A valve is required at the upstream end of each branch, as well as at the source.
  - 2) A valve at only the line source may not be sensitive enough to halt flow if a rupture occurs in a smaller branch, since it must have capacity to feed both branches.
  - 3) A valve is required at the source of a line feeding the branches, to prevent whipping should a rupture occur upstream from the "Y".

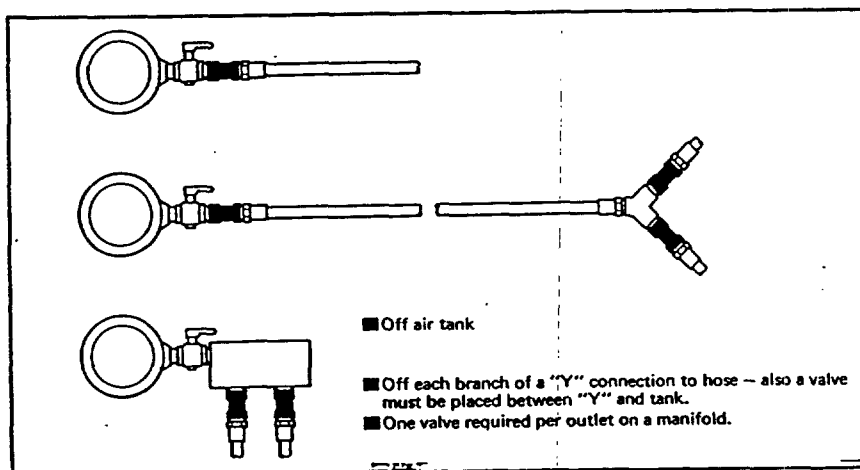


Figure 2. Location of valves in typical air lines.

### 5. REFERENCES

- o 29 Code of Federal Regulations, Part 1926, Section 1926.302, Paragraph 7 - "Power-Operated Hand Tools".

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# Engineering Standard



Mechanical

## EXCESS AIR FLOW SAFETY VALVES

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### 6. APPENDIX

TABLE 1

#### EXCESS AIR FLOW SAFETY VALVES<sup>1</sup>

| Manufacturer                                                                                   | Valve Size<br>(NPT) | Approximate Shut-Off Flow at<br>100 psig Inlet Pressure <sup>2</sup><br>SCFM |
|------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------|
| Hansen<br>4050 W. 150 St.<br>Cleveland, Ohio 44135                                             | 1/4                 | 20                                                                           |
|                                                                                                | 3/8                 | 50                                                                           |
|                                                                                                | 1/2                 | 80                                                                           |
|                                                                                                | 3/4                 | 130                                                                          |
|                                                                                                | 1                   | 210                                                                          |
|                                                                                                | 1-1/2               | 450                                                                          |
|                                                                                                | 2                   | 850                                                                          |
| Le-Hi Valve and Coupling<br>Parker-Hannifin<br>30240 Lakeland<br>Wickliffe, Ohio 44092         | 3/4                 | 130                                                                          |
|                                                                                                | 1                   | 210                                                                          |
| Perfecting Service Div.<br>G. W. Murphy Industries<br>P. O. Box 1949<br>Charlotte, N. C. 28201 | 1/4                 | 26                                                                           |
|                                                                                                | 3/8                 | 58                                                                           |
|                                                                                                | 1/2                 | 92                                                                           |
|                                                                                                | 3/4                 | 180                                                                          |
|                                                                                                | 1                   | 300                                                                          |
|                                                                                                | 1-1/4               | 470                                                                          |
|                                                                                                | 1-1/2               | 710                                                                          |
|                                                                                                | 2                   | 1050                                                                         |
|                                                                                                | 3                   | 2700                                                                         |
| Rego<br>4201 W. Peterson Ave.<br>Chicago, Ill. 60646                                           | 3/8                 | 51                                                                           |
|                                                                                                | 1/2                 | 85                                                                           |
|                                                                                                | 3/4                 | 130                                                                          |
|                                                                                                |                     | 200                                                                          |
|                                                                                                | 1                   | 350                                                                          |
|                                                                                                |                     | 400                                                                          |
|                                                                                                | 1-1/2               | 600                                                                          |
|                                                                                                |                     | 272                                                                          |
|                                                                                                | 2                   | 420                                                                          |
|                                                                                                |                     | 693                                                                          |
|                                                                                                | 3                   | 453                                                                          |
|                                                                                                |                     | 721                                                                          |
| Snap-tite<br>Union City, Pa. 16438                                                             | 4                   | 1268                                                                         |
|                                                                                                |                     | 906                                                                          |
|                                                                                                | 1/2                 | 1690                                                                         |
|                                                                                                |                     | 3171                                                                         |
|                                                                                                | 3/4                 | 3150                                                                         |
|                                                                                                |                     | up to 70 <sup>3</sup>                                                        |
|                                                                                                | 1                   | up to 100                                                                    |
| Thomas C. Wilson, Inc.<br>21-11 44th Avenue<br>Long Island City, N.Y. 11101                    | 1                   | up to 150                                                                    |
|                                                                                                | 1-1/2               | up to 300                                                                    |
|                                                                                                | 2                   | up to 700                                                                    |
|                                                                                                | 1/4                 | 15                                                                           |
|                                                                                                | 3/8                 | 42                                                                           |
|                                                                                                | 1/2                 | 68                                                                           |
|                                                                                                | 3/4                 | 84                                                                           |
|                                                                                                |                     | 120                                                                          |
|                                                                                                | 1                   | 140                                                                          |
|                                                                                                |                     | 190                                                                          |
|                                                                                                | 1                   | 260                                                                          |
|                                                                                                | 1-1/4               | 470                                                                          |
|                                                                                                | 1-1/2               | 680                                                                          |
|                                                                                                | 2                   | 840                                                                          |

<sup>1</sup> This is a partial list. These manufacturers are not recommended over others not listed.

<sup>2</sup> For shut-off flow rates at other inlet pressures, P,

Shut-Off Flow = (SCFM at 100 psig)  $\sqrt{\frac{P + 14.7}{104.7}}$

<sup>3</sup> f @ 85 to 130 psi working pressure.

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