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National Distributor of Quality
Maintenance Supplies Since 1958

PRODUCT TRAINING MANUAL

for

HYDRAULIC PRODUCTS

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HYDRAULIC SYSTEM COURSE OUTLINE

PURPOSE:

To guarantee consistency within your organization as it relates to identifying, and selecting hydraulic hoses and fittings.

OBJECTIVES: Technicians will be able to:

- Identify hydraulic hose and hose ends.
- Recognize common hydraulic hose failures and analyze their causes.
- List procedures and demonstrate skills for making proper hydraulic connections.
  - » Cutting
  - » Cleaning
  - » Connecting
  - » Protecting
  - » Securing
  - » Identifying

OVERVIEW:

I. Glossary
II. Agency Standards
III. General Hose Information and Identification
IV. Hose Failure Analysis
V. Weatherhead Hose Numbering System
VI. Imperial's Weatherhead Hose Selection
VII. Fitting Identification
VIII. Six Step Method
IX. Proper Installation
X. Crimping Procedure
XI. Important Safety Information

I. GLOSSARY

Abrasion: external damage to a hose assembly caused by rubbing against a foreign object; a wearing away by friction.

ABS: Air Brake Swivel

ANSI: American National Standards Institute.

Assembly: a general term referring to any hose coupled with end fittings of any style attached to one or both ends.

ASTM: American Society of Testing and Materials.

Barb: the portion of a fitting (coupler) that is inserted into the hose, usually comprised of two or more radial serrations or ridges designed to form a redundant seal between the hose and fitting.

Bend Radius: the radius of a bent section of hose measured to the innermost surface of the curved portion.

Bend Radius, Minimum: the smallest radius at which hose or tubing can be used. For Metal Hose: the radius of a bend measured to the hose centerline, as recommended by manufacturer.

Braid: the woven portion of a hose used as reinforcement to increase pressure rating and add hoop strength. Various materials such as polyester, cotton or metal wire are used. A hose may have one or more braids, outside or between layers of hose material.

Braided Ply: a layer of braided reinforcement.

Brass: a family of copper/zinc alloys.

BSPP/BSPT: British Standard Pipe Parallel / British Standard Pipe Tapered.

Checking: the short, shallow cracks on the surface of a rubber product resulting from damaging action of environmental conditions.

Chemical Resistance: the ability of a particular polymer, rubber compound, or metal to exhibit minimal physical and/or chemical property changes when in contact with one or more chemicals for a specified length of time, at specified concentrations, pressure, and temperatures.

Coll-O-Crimp: Registered trademark of Eaton Corporation for a line of hydraulic and pneumatic hose, hose end fittings, and fabrication equipment.

Core: the inner portion of hose, usually referring to the material in contact with the medium.

Corrosion Resistance: ability of metal components to resist oxidation.

Cover: the outer component usually intended to protect the carcass of a product.

Crimp Diameter: the distance across opposite flats after crimping.

Crimp/crimping: a hose end fitting attachment method utilizing a number of dies mounted in a radial configuration. The dies close perpendicular to the hose fitting axis, compressing the collar ferrule, or sleeve around the hose.

Cut Off Factor: the hose length to be subtracted from the overall assembly length that allows for the hose coupling end connection extension beyond the end of the hose.

DOT: Department of Transportation

DIN: Deutsch Industry Norm

EPDM: Ethylene Propylene Diene Monomer; an elastomer.

Fatigue: the weakening or deterioration of a material occurring when a repetitious or continuous application of stress caused strain, which could lead to failure.

FDA: United Food and Drug Administration

Fitting/coupling: a devise attached to the end of the hose to facilitate connection.

- **Compression Fitting:** a fitting style that seals on a mating tube by compressing an internal ferrule against the tube O.D.
- **Inverted Flare Fitting:** a fitting consisting of a male or female nut, trapped on a tube by flaring the end of the tube material to either 37 degrees or 45 degrees.
- **JIC Fittings:** Joint Industrial Council (no longer in existence). An engineering group that established an industry standard fitting design incorporating a 37 degree mating surface, male and female styles. These standards are now governed by SAE.
- **O-ring Fittings:** a fitting that seals by means of an elastomeric ring of a specified material.
- **Pipe Thread Fittings:**

  NPT – National Pipe Taper. Pipe thread per ANSI B1.20.3

  NPTF – National Pipe Tapered for Fuel. (Same as above except dry-seal per ANSI B1.20.3)

NPSH – National Pipe Straight Hose per ANSI B1.20.7

NPSM – National Pipe Straight Mechanical. Straight thread per ANSI B1.20.1

NPSL – National Pipe Straight Loosefit per ANSI B1.20.1

BSPP, BSPT – British Standard Pipe Parallel, British Standard Pipe Taper. BS21

Quick Connect Fitting – a fitting designed to quickly connect and disconnect. These fittings come in many styles and types.

Tube Fitting – a hose fitting of which the mating end conforms to a tube diameter. The mate or male end of a compression fitting.

FOR-SEAL: a product name for a hose end configuration using an o-ring sealing method, trademarked by Eaton Corporation.

GPM: gallons per minute.

Hose: a flexile conduit consisting of a tube, reinforcement, and usually an outer cover.

I.D.: The abbreviation for inside diameter.

Insert: optional term for nipple.

ISO: International Organization of Standardization.

Layline: the line of printed information that runs parallel on the side of a manufactured hose giving details such as part number, PSI rating, hose size and manufacturing data.

Nipple: the internal member or portion of a hose fitting.

Nitrile rubber (NB/Buna-N): a family of acrylonitrile elastomers used extensively for industrial hose.

Nominal: a size indicator for reference only.

NPT/NPTF: abbreviation for national pipe thread.

Nylon: a family of polyamide material.

Oil Resistance: the ability of the materials to withstand exposure to oil.

Operating Conditions: the pressure, temperature, motion, and environment to which a hose assembly is subject.

Overall Length (OAL): the total length of a hose assembly, which consists of the free hose length plus the length of the coupling(s).

Oxidation: the reaction of oxygen on a material, usually evidenced by a change in the appearance or feel of the surface or by a change in physical properties.

Pin Pricked: perforations through the cover of a hose to vent permeating gases.

Pitch: 1) the distance from a point on a helix to the corresponding point on the next turn of the helix, measured parallel to the axis: 2) the distance between the two peaks of adjacent corrugation convolution.

Plating: a material, usually metal, applied to another metal by electroplating, for the purpose of reducing corrosion: typically a more noble metal such as zinc is applied to steel.

Ply: an individual layer in hose construction.

Pressure, burst: the pressure at which rupture occurs.

Pressure, working: the maximum pressure to which a hose will be subjected, including the momentary surges in pressure, which can occur during service. Abbreviated as WP.

PSI: pounds per square inch.

PVC: polyvinyl chloride. A low cost thermoplastic material typically used in the manufacture of industrial hose. The operating temperature range is -500 degrees Fahrenheit to +1750 degrees Fahrenheit.

Reinforcement: the strengthening members, consisting of fabric, cord, and/or metal, of a hose.

SAE: Society of Automotive Engineers.

Sleeve: a metal cylinder, which is not physically attached to the fitting, for the purpose of forcing the hose into the serrations of the fitting.

Spiral: a method of applying reinforcement in which there is not interlacing between individual strands of the reinforcement.

Spring Guard: a helically wound component applied internally or externally to a hose assembly, used for strain relief, abrasion resistance, collapse resistance.

Tube: the inner most continuous all-rubber or plastic element of a hose.

Weathering: the surface deterioration of a hose cover during outdoor exposure, as shown by checking, cracking, crazing and chalking.

WP: the abbreviation for working pressure.

II. AGENCY STANDARDS

REGULATORY AGENCIES / INDUSTRY ASSOCIATIONS / & STANDARDS DEFINITIONS

AGENCY	DEFINITION
AAMVA	American Association of Motor Vehicle Administration
AAR	American Association of Railroads
ANSI	American National Standards Institute
API	American Petroleum Institute
ASAE	American Society of Agricultural Engineers
ASEE	American Society for Engineering Education
ASLE	American Society of Lubrication Engineers
ASTM	American Society for Testing and Materials
ATA	American Truck Association
BIA	Boating Industry Association
BSI	British Standards Institute
BSP	British Standard Pipe (Parallel & Tapered)
CAG	Compressed Air & Gas Institute
CETOP	European Committee on Oil Hydraulic & Pneumatic Control
CGA	Canadian Gas Association
CGSB	Canadian Government Specifications Board
CIMA	Construction Industry Manufacturers Association
DIN	Deutsch Industry Norm (Germany)
DNV	Det Norske Veritas for North Sea Floating Vessels
DOD	U.S. Department of Defense
DOT	Department of Transportation
FDA	Food And Drug Administration
FCI	Fluid Controls Institute
FMVSS	Federal Motor Vehicle Safety Standard - 106
FPDA	Fluid Power Distributors of America
FPS	Fluid Power Society
FSA	Fluid Sealing Association
GAZ	French Metric Standard
HTMA	Hydraulic Tool Manufacturers Association
IFI	Industrial Fastener Institute
IJS	Industrial Jack Standards
ISO	International Standards Organization
ITA	Industrial Truck Association
JIC	Joint Industry Council
JIS	Japanese Industrial Standard
MHI	Material Handling Institute
MIL (MS)	U.S. Military / Department of Defense
MSHA	Mine Safety & Health Administration
MVMA	Motor Vehicle Manufacturers Association
NCB	National Coal Board - 174
NFPA	National Fluid Power Association
NHTSA	National Highway Traffic Safety Administration
NMMA	National Marine Manufacturers Association
NMTBA	National Machine Tool Builders Association
NPFC	Navel Publications & Forms Center
NPSF	National Pipe Straight Thread - Fuels
NPSM	National Pipe Straight Thread - Mechanical Joint
NPTF	National Pipe Tapered Thread - Fuels
OSHA	Occupational Safety & Health Administration
PCSA	Power Crane & Shovel Association
PHA	Public Health Administration
RAC	Rubber Association of Canada
RCCC	Regulated Common Carrier Conference for Fleet, Truck, Bus
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SME	Society of Manufacturing Engineers
TFI	The Fertilizer Institute
UL	Underwriters Laboratories (Electrical Approval)
USDA	United States Drug Administration
USCG	United States Coast Guard

NATIONAL STANDARDS

NATIONAL STANDARDS INSTITUTES

Country	Abbreviation[1]
Albania	BSA
Algeria	INAPI
Australia	SAA
Austria	ON
Bangladesh	BDSI
Belgium	IBN
Brazil	ABNT
Bulgaria	DKC
Canada	SCC
Chile	INN
China	CAS
Colombia	ICONTEC
Cuba	NC
Czechoslovakia	CSN
Denmark	DS
Egypt, Arab Rep. of	EOS
Ethiopie	ESI
Finland	SFS
France	AFNOR
[2] Germany, F.R.	DIN
Ghana	GSB
Greece	ELOT
Hungary	MSZH
India	ISI
Indonesia	YDNI
Iran	ISIRI
Iraq	IOS
Ireland	IIRS
Israel	SII
Italy	UNI
Ivory Coast	BIN
Jamaica	JBS
Japan	JISC
Kenya	KEBS

Country	Abbreviation[1]
Korea, Dem. P. Rep. of/	CSK
Korea, Rep. of	KBS
Lebanon	LIBNOR
Lybian Arab Jamhiriya	LYSSO
Malaysia/	SIRIM
Mexico/	DGN
Morocco	SNIMA
Netherlands/	NNI
New Zealand/	SANZ
Nigeria	NSO
Norway	NSF
Pakistan	PSI
Peru	ITINTEC
Philippines	PS
Poland/	PKNIM
Portugal	IGPAI
Romania	IRS
Saudi Arabia/	SASO
Singapore	SISIR
South Africa, Rep. of	SABS
Spain	IRANOR
Sri Lanka	BCS
Sudan/	SSD
Sweden/	SIS
Switzerland	SNV
Thailand	TISI
Turkey	TSE
United Kingdom	BSI
[1] USA	ANSI
USSR	GOST
Venezuela	COVENIN
Viet Nam, Socialist Republic of	TCVN
Yugoslavia	JZS

Examples

[1] American National Standards Institute–ANSI

[2] Deutsches Institut für Normung–DIN

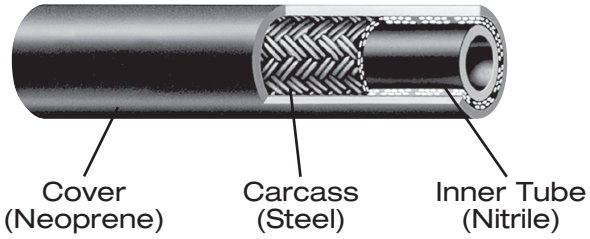
III. GENERAL HOSE INFORMATION & IDENTIFICATION

CHARACTERISTICS: Hose is used to convey fluid power from one point to another. Its main advantage over metal tubing and pipe, which are considered permanent, is its ability to flex and bend around corners without using couplings and elbows. The flexibility makes the connection immune to fatigue. Fluid power connections can easily be made from a stationary body to another which must move. Hose has a resiliency which allows it to regain its original shape after flexing, bending or other movement.

Hose is also expandable. Power line surges will cause the hose to expand, but this expansion will reduce the sudden impact of power transfer through the system. The system runs smoother with less damage to diaphragms, seals and other parts. Hose also has a dampening effect which reduces vibration and noise, making the system run cooler and quieter.

CONSTRUCTION: The three basic components to a hose are; the inner tube, carcass, and cover.

Hydraulic fluid is conveyed through the inner tube. This tube is most commonly made from Buna-N. However, a variety of other materials are available; including Neoprene, Butyl, Nylon, Teflon and EPDM. It is essential that the proper compound be selected for compatibility with the fluid type for optimum life and performance.



The carcass provides strength and reinforcement to the inner tube. Carcass materials range from cotton, nylon, carbon steel wire and stainless steel wire. These materials are applied in several different ways. Cotton and nylon are braided around the inner tube to provide more flexibility. Carbon steel and stainless steel are also braided to offer more strength. For high pressure hoses, the carbon steel and stainless steel wires are wrapped in a spiral design for added strength against power peaks and surges. The least common carcass pattern is a helical coil. This uses carbon steel in a loose helical pattern, resembling a spring, to help retain the shape of the hose, rather than adding strength to the hose.

The cover protects the carcass and inner tube from external hazards: chemical attack, heat, ultra-violet, fire, impact and abrasion. Neoprene is the most common material used, but others include cotton, nylon, polyurethane and hypalon.

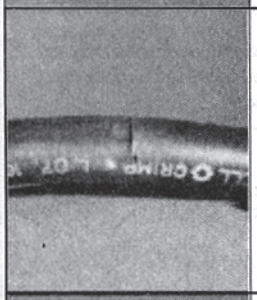
IV. HOSE FAILURE ANALYSIS

1. Problem: Hose has burst. Rusted wire, torn and rotted fibers are present. This was caused by abrasion damage. Exposure to elements will accelerate the deterioration.

   Solution: Route the hose so it does not rub against other objects while under pressure. Suggest using clamps and spring guards to protect.

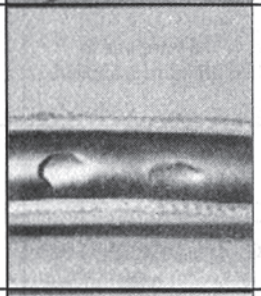
2. Problem: Hose has burst on outside bend of hose. This hose has been bent past minimum bend radius. It has also taken a set in a bent position due to a kink in the inner tube or reinforcement.

   Solution: Check minimum bend radius for hose. Refer to page 26 to determine minimum bend radius. Utilize bend tube elbows if possible.



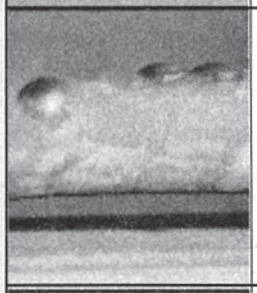
3. Problem: Excessive heat. Hose cover or inner tube is brittle and cracked and is not flexible at room temperature.

   Solution: Use hose with higher temperature rating or protect from heat with shields. Examine entire system for potential heat source. For example: undersized lines, excessively long lines, too many bends and/or fittings, reservoir low on oil.



4. Problem: Incompatible fluid. Portions of the inner tube are swollen and/or washed out. Cover may also be swollen.

   Solution: Make sure hose used is compatible with fluid being used. Refer to chemical compatibility chart.



5. Problem: Hose cover blistered and pulling away from carcass. Gas has effused through the tube and become trapped under the cover.

   Solution: Use perforated, pin-pricked or fiber cover hose.

6. Problem: End fitting blown off. Im-proper assembly procedures, incorrect hose end series, mixing competitor's components and Weatherhead components.

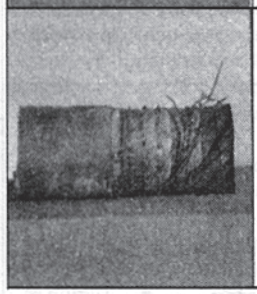
   Solution: Refer to hose assembly procedures and Hose End and Tool Selector Chart in this catalog. NEVER intermix components. Refer to pages 1-2 for important safety information.

7. Problem: Hose has burst cleanly with no random wire breakage and cover abrasion. This condition is caused by excessive pressure.

   Solution: Use hose with higher pressure rating. Check pressure relief for damage or improper setting.

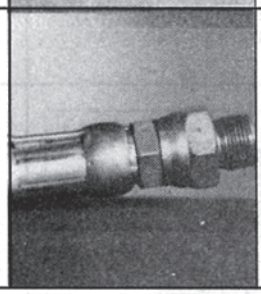
8. Problem: Hose has burst. Hose is permanently twisted and kinked. Many broken wires in failure area.

   Solution: Hose twisting can reduce hose life 90%. Tighten ends properly. Reroute hose to eliminate twist. Route hose to flex in only one plane. Use hose layline for a guide.



9. Problem: End fitting blown off. This condition has been caused by improper skiving. Any remaining cover on hose in the crimping area will prohibit proper end retention.

   Solution: Make sure hose is properly skived. Refer to page 25 for hose skiving instructions.



10. Problem: Hose end appears to have been pinched on one side.

    Solution: This is an early sign of collet wear. Replace collet. New Weatherhead® collets offer the feature of being rebuildable. See the tool section chart in the back of this catalog.

⚠ **WARNING** – Selection of Hose: Selection of the proper hose for the application is essential to the proper operation and safe use of the hose and related equipment. Inadequate attention to selection of hose for application can result in serious bodily injury or property damage. In order to avoid serious bodily injury or property damage resulting from selection of the wrong hose, you should carefully review the information in this catalog. Refer to Selection of Hose and Hose Installation (page 3-11 and page 26) for additional safety information. Hose failures can be caused by conditions such as excessive pressures, fluid incompatibility, extreme temperatures, and many more. Eaton has illustrated above some of the more common failures. If the conditions you are experiencing are not listed, please contact your Eaton representative for further assistance.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

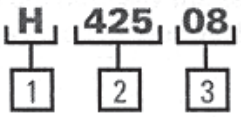
V. WEATHERHEAD HOSE NUMBERING SYSTEMS

Hose

1. All Weatherhead hose is designated with the letter 'H.'
2. Each hose is assigned a three digit base number from 001-999, i.e., H069, H425, H470, H1571.
3. The last two digits indicate inside hose diameter (I.D.) in sixteenths of an inch. In the example used above 08 is equal to 8/16" – or 1/2" I.D. hose.

   Exceptions: H059, H069, H166, H169, H213, H229, H239, H366, H429, H569 and H757. The I.D. sizes of these hoses deviate somewhat from the above standard. The sizing method used on these hoses is based on deducting twice the wall thickness from the O.D. of the connecting tubing to determine the I.D. of the hose. In other words, match the inside diameters rather than the dash sizes when going from tubing to hose. See example 1.

Table 1 shows standard hose size and H069 type hose sizes and dash numbers. Wherever these hoses are listed in this catalog, the size is listed and the dash number is the last two digits of the Catalog Number.



Examples:

	ACTUAL HOSE I.D.	NOMINAL HOSE I.D.	TUBING I.D.	TUBING O.D.
H06906	5/16	3/8	5/16	3/8
H06910	1/2	5/8	1/2	5/8

Table 1 – Catalog Numbers for Hose Sizes

ACTUAL HOSE I.D.	STANDARD CATALOG NUMBERS	H069 TYPE CATALOG NUMBERS
3/16	03	04
1/4	04	05
5/16	05	06
3/8	06	
13/32	08	
7/16	07	
1/2	08	10
5/8	10	12
3/4	12	
7/8		16
1	16	
1-1/8		20
1-1/4	20	
1-3/8		24
1-1/2	24	
1-13/16		32
2	32	
2-3/8		40
3		48

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

WEATHERHEAD HOSE NUMBERING SYSTEMS

Hose Ends

Every type of Weatherhead hose end is designed to fit a certain group of hose with limiting dimensions and tolerances. For your convenience the hoses used on each end style are indicated in the hose end catalog listings.

Crimp

1. The first two digits indicate hose size (I.D.) in sixteenths of an inch.

   The exceptions to this are the **spiral and truck hose.**

   Spiral hose ends use the hose base number as a prefix to the size. Example: 47012E.

   Truck hose ends use the base number 069 as a prefix to the size. Example: 06908E.

   Refer to the top of the catalog page where these hose ends are detailed for recommended hose types.
2. Hose end type and material. Refer to Table 2. This letter is always followed by a dash.
3. The first number or letter indicates the style of the end connection. See individual hose end catalog listings or refer to the hose end configuration chart on pages 22-25.
4. The last two digits indicate the size of the end connection in sixteenths of an inch. Refer to individual catalog listing for metric and specialty ends.

08 U-2 58

① ② ③ ④

Field Attachable

1. Description of basic hose.

   The exceptions are the 247 series and clamp-type ends. These ends are designed for use with a variety of hose types.

   Refer to the top of the catalog page where these hose ends are detailed for recommended hose types.
2. Hose size (I.D.) in sixteenths of an inch, or as shown in Table 1.
3. Hose end type and material. Refer to Table 2. This letter is always followed by a dash.
4. The first number or letter indicates the style of the end connection. See individual hose end catalog listings or refer to the hose end configuration chart on pages 22-25.
5. The last two digits indicate the size of the end connection in sixteenths of an inch. Refer to individual catalog listing for metric and specialty ends.

425 08 N-2 58

① ② ③ ④ ⑤

Numbering Systems

Table 2 – Standard Hose End and Material Code

CODE LETTER	COUPLING TYPE	MATERIAL
A	Crimp/Field Attachable	Aluminum
B	Field Attachable	Brass
C	Crimped	Brass
D	Field Attachable*	Steel*
E	Crimp	Steel
H	Crimp	Brass
K	Clamp Type	Steel
M	Crimp	Steel
N	Field Attachable	Steel
P	Crimp	Brass
S	Crimp	Stainless Steel
T	Field Attachable*	Brass
U	Crimp	Steel
W	Crimp	Steel

*High Flow Hose Assemblies

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

GENERAL PURPOSE HOSE

H100 GENERAL PURPOSE HOSE

- Fabric cover.
- Applications: low pressure air, diesel fuel, oil and water lines
- Temperature range: -40° F to 212° F

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One fiber braid
» Cover: Fiber braid

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92000	H10004	1/4	1/2	350 psi	1,400 psi	3"	50	Low Pressure Barb-Tite 100 B Series on page H18
92001	H10006	3/8	5/8	350 psi	1,400 psi	3"	50	
92002	H10008	1/2	3/4	350 psi	1,400 psi	5"	50	
92003	H10010	5/8	29/32	350 psi	1,400 psi	6"	50	
92004	H10012	3/4	1-1/32	350 psi	1,400 psi	7"	50	

H101 GENERAL PURPOSE HOSE

- Rubber cover.
- Applications: low pressure air, diesel fuel, oil and water lines
- MSHA accepted.
- Temperature range: -40° F to 212° F

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One fiber braid
» Cover: Black neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92005	H10104	1/4	1/2	1,400 psi	3"	50	Low Pressure Barb-Tite 100 B Series on page H18
91999	H10105	5/16	9/16	1,400 psi	3"	50	
92006	H10106	3/8	5/8	1,400 psi	3"	50	
92006-4	H10106-250R	3/8	5/8	1,400 psi	3"	250	
92007	H10108	1/2	3/4	1,400 psi	5"	50	
92008	H10110	5/8	29/32	1,400 psi	6"	50	
92009	H10112	3/4	1-1/32	1,400 psi	7"	50	

H201 GENERAL PURPOSE HOSE

- Applications include: low pressure air, diesel fuel, oil and water lines
- Gasohol or diesohol fuel containing more than 10% alcohol may reduce hose life.
- MSHA accepted. (black only).
- Temperature range: -40° F to 200° F

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One fiber braid
» Cover: (Black) neoprene, (colors) vinyl nitrile

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92054	H20104	1/4	1/2	250 psi	1,000 psi	3"	50	Low Pressure 100 B Series on page H18
92054-4	H20104-500R	1/4	1/2	250 psi	1,000 psi	3"	500	
92055	H20106	3/8	5/8	350 psi	1,000 psi	3"	50	
92056	H20108	1/2	3/4	250 psi	1,000 psi	5"	50	
92057	H20110	5/8	29/32	250 psi	1,000 psi	6"	50	
92058	H20112	3/4	1-1/32	250 psi	1,000 psi	7"	50	

H115 OIL RESISTANT GENERAL PURPOSE HOSE

- Applications include: medium oil resistant, water.
- Ideal for pneumatic tool operation.
- Temperature range: -40° F to 180° F
- Color: Red

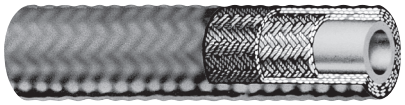
CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: Multi-fiber braid
» Cover: Vinyl nitrile

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92135	H11506	3/8	23/32	300 psi	1,200 psi	3-1/2"	50	430 U-Series on page H14-H15
92136	H11508	1/2	7/8	300 psi	1,200 psi	4-1/2"	50	
92137	H11512	3/4	1-5/32	300 psi	1,200 psi	5-3/4"	50	
92138	H11520	1-1/4	1-3/4	225 psi	900 psi	8-3/4"	50	

MEDIUM PRESSURE HOSE

H435 MEDIUM PRESSURE, NON-CONDUCTIVE HOSE



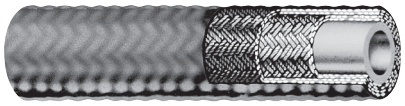
- Compatible with most hydraulic fluids.
- Designed for use where electric shock hazards exist.
- Maximum leakage is 50 micro amperes per foot at 75 KV per foot for five minutes.
- Meets or exceeds SAE 100R7.
- Temperature range: -40° F to 200° F (-40° C to 93° C)

CONSTRUCTION:

» Inner tube: Nylon 11
» Reinforcement: Two fiber braids
» Cover: Orange, non-conductive polyurethane

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
93570	H43504	1/4	29/64	2,750 psi	11,000 psi	1"	50	E-Series on page H16 or Reusable Ends N-Series for H435 & H436 Hose on page H9
93570-4-500R	H43504	1/4	29/64	2,750 psi	11,000 psi	1"	500	
93571	H43505	5/16	9/16	2,500 psi	10,000 psi	1-1/2	50	
93572	H43506	3/8	5/8	2,250 psi	9,000 psi	2"	50	
93572-4-250R	H43506	3/8	5/8	2,250 psi	9,000 psi	2"	250	
93573-4-250R	H43508	1/2	13/16	2,000 psi	8,000 psi	2-1/2	250	

H436 MEDIUM PRESSURE PERFORATED COVER HOSE



- Compatible with most hydraulic fluids.
- Perforated cover permits breathing, eliminating condensation and blistering.
- Meets or exceeds SAE 100R7.
- Low effusion rate makes it ideally suited for CO2 and nitrogen.
- Temperature range: -40° F to 200° F (-40° C to 93° C)

CONSTRUCTION:

» Inner tube: Nylon 11
» Reinforcement: Two fiber braids
» Cover: Black polyurethane (perforated)

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
93540	H43604	1/4	29/64	2,750 psi	11,000 psi	1"	50	E Series on page H16 or H436 N-Series on page H9
93541	H43605	5/16	9/16	2,500 psi	10,000 psi	1-1/2	50	
93542	H43606	3/8	5/8	2,250 psi	9,000 psi	2"	50	
93543	H43608	1/2	51/64	2,000 psi	8,000 psi	2-1/2	50	

H104 HYDRAULIC HOSE

- Most commonly used for medium pressure hydraulic lines for farm equipment.
- USCG fuel/lube systems accepted.
- MSHA accepted, meets or exceeds SAE 100R1 Type AT, ABS.
- Temperature range: -40° F to 212° F (-40° C to 100° C)

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One steel braid
» Cover: Neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Bend Radius	Qty. Feet	Use With Hose Ends
93420	H10404	1/4	17/32	2,750 psi	11,000 psi	4"	50	U-Series on page H12-H14
93420-4	H10404-250R	1/4	17/32	2,750 psi	11,000 psi	4"	250	
93421	H10406	3/8	11/16	2,250 psi	9,000 psi	5"	50	
93421-4	H10406-250R	3/8	11/16	2,250 psi	9,000 psi	5"	250	
93422	H10408	1/2	13/16	2,000 psi	8,000 psi	7"	50	
93422-4	H10408-250R	1/2	13/16	2,000 psi	8,000 psi	7"	250	
93425	H10410	5/8	15/16	1,500 psi	6,000 psi	8"	50	
93423	H10412	3/4	1-3/32	1,250 psi	5,000 psi	9-1/2"	50	
93424	H10416	1"	1-13/32	1,000 psi	4,000 psi	12"	50	

LP GAS HOSE

H366 LP GAS HOSE

- Most commonly used for medium pressure LP gas service.
- UL listed for LP gas applications.
- Temperature range: -40° F to 300° F, (-40° C to 149° C)

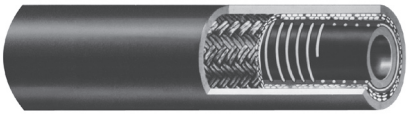
CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One fiber braid, one stainless steel braid.
» Cover: Fiber braid

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
93704	H36606	5/16	43/64	350 psi	1,750 psi	4"	50	069 E-Series on page H16 or 247 N Series on page H8

SUCTION HOSE

H039 SUCTION HOSE



- Marine application J1942/1 hydraulic only, ABS and MSHA accepted.
- Primary application: hydraulic suction hose.
- Temperature range: -40° F to 300° F

CONSTRUCTION:

» Inner Tube: CPE
» Reinforcement: One helical cable wire between two textile layers. One fiber braid.
» Cover: Neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
91950	H03912	3/4	1-3/8	300 psi	1,200 psi	5"	50	U-Series on page H12-H14 or 430 U-Series on page H14-H15
91951	H03916	1"	1-5/8	250 psi	1,000 psi	6"	50	
91954	H03932	2"	2-1/2	100 psi	400 psi	12"	50	

TRUCK HYDRAULIC HOSE

H213 TRUCK HOSE

- Applications include: air brake, fuel and diesel fuel lines and high temperature petroleum oil applications
- SAE J1402 Type AI DOT AI.
- Temperature range: Air: -40° F to 200° F (-40° C to 93° C). Hot oil: -50° F to 302 F (-45° C to 150° C)
- 16 size, Part No. 93506 is not for DOT applications.

CONSTRUCTION:

» Inner tube: CPE
» Reinforcement: One fiber braid, one steel braid
» Cover: Black fiber braid with two green stripes 180° apart

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
93500	H21304	3/16	31/64	2,000 psi	8,000 psi	3/4	50	H213 Series Reusable Ends on page H8
93501	H21305	1/4	35/64	1,500 psi	6,000 psi	1"	50	
93502	H21306	5/16	39/64	1,500 psi	6,000 psi	1-1/4	50	
93503	H21308	13/32	47/64	1,250 psi	5,000 psi	1-3/4	50	
93504	H21310	1/2	53/64	1,000 psi	4,000 psi	2-1/4	50	
93505	H21312	5/8	61/64	750 psi	3,000 psi	2-3/4	50	
93506	H21316	7/8	1-13/64	400 psi	1,600 psi	3-1/2	50	

H069 GENERAL PURPOSE HOSE

- General purpose truck and hydraulic hose is suitable for use with trucks, forklifts and off-highway vehicles.
- For use in air brake, fuel, grease lines, high temperature petroleum oils and medium pressure hydraulic applications.
- Meets or exceeds SAE 100R5, SAE J1402 TYPE II and DOT AII (formerly SAE J1402 Type AII class 1).
- 16 size hose, Part No. 93406 is not for DOT applications.
- Pennsylvania state approved for air brake lines.
- Temperature range: -40° F to 212° F

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: One fiber braid, one steel braid
» Cover: Fiber braid

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
93400	H06904	3/16	33/64	3,000 psi	12,000 psi	3"	50	E-Series on page H16 or 247 N-Series on page H8
93401	H06905	1/4	37/64	3,000 psi	12,000 psi	3-3/8	50	
93402	H06906	5/16	43/64	2,250 psi	9,000 psi	4"	50	
93403	H06908	13/32	49/64	2,000 psi	8,000 psi	4-5/8	50	
93404	H06910	1/2	59/64	1,750 psi	7,000 psi	5-1/2	50	
93405	H06912	5/8	1-5/64	1,500 psi	6,000 psi	6-1/2	50	
93406	H06916	7/8	1-15/64	800 psi	3,200 psi	7-3/8	50	

H569 HYDRAULIC HOSE

- ABS approved sizes for 5/16" to 1-1/4".
- Applications: general purpose truck, marine and hydraulic hose. For air brake (4-12), diesel fuel, grease lines, high temperature petroleum oils and medium pressure hydraulic applications.
- Temperature range: hydraulic fluid: -55° F to 302° F,
- Air brake: -40° F to 200° F, Air: -40° F to 212° F
- SAE 100R5, SAE J1402 Type AII, DOT AII*, ABS

CONSTRUCTION:

» Inner tube: CPE
» Reinforcement: Two fiber braids and one steel braid.
» Cover: Fiber braid

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
93410	H56904	3/16	33/64	3,000 psi	12,000 psi	3"	50	069 E-Series on page H16 or 247 N-Series on page H8
93412	H56906	5/16	43/64	2,250 psi	9,000 psi	4"	50	
93413	H56908	13/32	49/64	2,000 psi	8,000 psi	4-5/8	50	
93414	H56910	1/2	59/64	1,750 psi	7,000 psi	5-1/2	50	
93415	H56912	5/8	1-5/64	1,500 psi	6,000 psi	6-1/2	50	

H145 HIGH PRESSURE HYDRAULIC HOSE

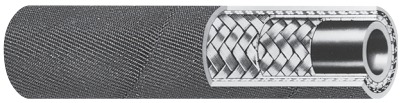
- Use in high pressure lines on off-road construction equipment, farm equipment and other high pressure applications where a small bend radius is needed.
- MSHA accepted.
- Meets or exceeds SAE 100R17.
- Reinforcement: Two steel braids (For 3/4" I.D. hose)
- Temperature range: -40° F to 212° F (-40° C to 100° C)

CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement:
Size 4 to 6: One steel braid
Size 8 to 16: Two steel braids
» Cover: Neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
93429	H14504	1/4	1/2	3,045 psi	12,180 psi	2"	50	Z-Series on page H17, U-Series on page H12-H14 or 430 U-Series on page H14-H15
93429-4	H14504-250R	1/4	1/2	3,045 psi	12,180 psi	2"	250	
93430	H14506	3/8	41/64	3,045 psi	12,180 psi	2-1/2"	50	
93431	H14508	1/2	13/16	3,045 psi	12,180 psi	3-1/2"	50	
93432	H14510	5/8	31/32	3,045 psi	12,180 psi	4"	50	
93433	H14512	3/4	1-5/32	3,045 psi	12,180 psi	4-3/4	50	
93433-4	H14512-250R	3/4	1-5/32	3,045 psi	12,180 psi	4-3/4	250	
93434	H14516	1"	1-15/32	3,045 psi	12,180 psi	6"	50	

H425 HIGH PRESSURE FLEET AND IMPLEMENT HOSE



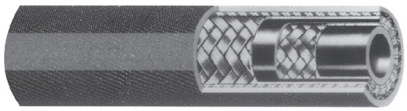
- Most commonly used for high pressure hydraulic lines on off-road construction equipment, farm equipment and other high pressure applications.
- USCG fuel/lube systems accepted.
- MSHA accepted.
- Meets or exceeds SAE 100R2 Type AT.
- Temperature range: -40° F to 212° F (-40° C to 100° C)

CONSTRUCTION:

» Inner tube: Neoprene (1/4"), nitrile (3/8" to 1-1/4")
» Reinforcement: Two steel braids
» Cover: Neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92600	H42504	1/4	19/32	5,000 psi	20,000 psi	4"	50	N-Series on page H9 U-Series on page H12-H14 or 430 U-Series Sizes -12 to -20 on page H14-H15
92600-4	H42504-250R	1/4	19/32	5,000 psi	20,000 psi	4"	250	
92601	H42506	3/8	3/4	4,000 psi	16,000 psi	5"	50	
92601-4	H42506-250R	3/8	3/4	4,000 psi	16,000 psi	5"	250	
92602	H42508	1/2	7/8	3,500 psi	14,000 psi	7"	50	
92602-4	H42508-250R	1/2	7/8	3,500 psi	14,000 psi	7"	250	
92605	H42510	5/8	1"	2,750 psi	11,000 psi	8"	50	
92605-4	H42510-250R	5/8	1"	2,750 psi	11,000 psi	8"	250	
92603	H42512	3/4	1-5/32	2,250 psi	9,000 psi	9-1/2	50	
92603-4	H42512-250R	3/4	1-5/32	2,250 psi	9,000 psi	9-1/2	250	
92604	H42516	1"	1-1/2	2,000 psi	8,000 psi	12"	50	
92604-4	H42516-250R	1"	1-1/2	2,000 psi	8,000 psi	12"	250	
92606	H42520	1-1/4	1-7/8	1,625 psi	6,500 psi	16-1/2	50	

H280 HIGH PRESSURE HYDRAULIC HOSE



- MSHA accepted, marine application J1942/1 hydraulic only.
- High pressure hose for hydraulic fluid, water transfer.
- Temperature range:
  petroleum-based hydraulic fluids: -40° to 212° F (-40° to 100° C)
  water-based hydraulic fluids: -40° to 158° F (-40° to 70° C)

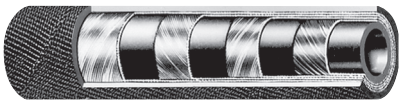
CONSTRUCTION:

» Inner tube: Nitrile
» Reinforcement: Two steel braids
» Cover: Vinyl nitrile

- NOTE : Special collets and spacer rings required to crimp.

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92594	H28004	1/4	17/32	5,800 psi	23,200 psi	2"	50	Z-Series Weather Grip Hose Ends on page H17
92595	H28006	3/8	11/16	4,800 psi	19,200 psi	2-1/2	50	
92596	H28008	1/2	13/16	4,000 psi	16,000 psi	3-1/2	50	
92596-4	H28008-250R	1/2	13/16	4,000 psi	16,000 psi	3-1/2	250	
92599	H28016	1"	1-13/32	2,400 psi	9,600 psi	6"	50	

H430 VERY HIGH PRESSURE HOSE



- Used for very high pressure hydraulic lines subjected to pressure surges and flexing.
- Typical applications include: construction, mining, farming and high performance industrial equipment
- Meets or exceeds SAE 100R12 specifications.
- Temperature range: -40° F to 250° F (-40° C to 121° C)

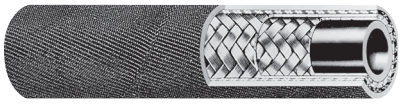
CONSTRUCTION:

» Inner tube: nitrile
» Reinforcement: Four spiral steel plies
» Cover: neoprene

Part No.	Cross Reference	Hose I.D.	O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92660	H43008	1/2	15/16	4,000 psi	16,000 psi	7"	50	430 U-Series No skive series on page H14-H15
92661	H43012	3/4	1-7/32	4,000 psi	16,000 psi	9-1/2	50	
92662	H43016	1"	1-33/64	4,000 psi	16,000 psi	12"	50	
92663	H43020	1-1/4	1-7/8	3,000 psi	12,000 psi	16-1/2	50	

HIGH PRESSURE HOSE

H245 HI-R FLEX™ HIGH PRESSURE HOSE



- Use on high pressure lines on off-road construction equipment, farm equipment and other high pressure applications.
- Use for water/glycol, water, generic hydraulic fluids and diesel fuel.
- MSHA accepted, exceeds SAE 100R16.
- Temperature range: -40° F to 212° F (-40° C to 100° C)
- Half the bend radius of SAE 100R2.

CONSTRUCTION:

» Inner tube: Nitrile blend
» Reinforcement: Two steel braids
» Cover: neoprene

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use with Hose Ends
92650	H24504	1/4	17/32	5,000 psi	20,000 psi	2"	50	U-Series on page H12-H14 or 430 U-Series Sizes -12 to -20 on page H14-H15
92650-4	H24504-250R	1/4	17/32	5,000 psi	20,000 psi	2"	250	
92651	H24506	3/8	19/32	4,000 psi	16,000 psi	2-1/2	50	
92651-4	H24506-250R	3/8	19/32	4,000 psi	16,000 psi	2-1/2	250	
92652	H24508	1/2	13/16	3,500 psi	14,000 psi	3-1/2	50	
92652-4	H24508-250R	1/2	13/16	3,500 psi	14,000 psi	3-1/2	250	
92653	H24510	5/8	15/16	2,750 psi	11,000 psi	4"	50	
92653-4	H24510-250R	5/8	15/16	2,750 psi	11,000 psi	4"	250	
92654	H24512	3/4	1-3/32	2,250 psi	9,000 psi	4-3/4	50	
92654-4	H24512-250R	3/4	1-1/8	2,250 psi	9,000 psi	4-3/4	250	
92655	H24516	1"	1-13/32	2,000 psi	8,000 psi	6"	50	
92655-4	H24516-250R	1"	1-13/32	2,000 psi	8,000 psi	6"	250	
92656	H24520	1-1/4	1-25/32	1,625 psi	6,500 psi	8-1/4	50	

H190 HIGH PRESSURE HYDRAULIC HOSE

- Primary Applications: transfer of hydraulic fluid, water and air
- MSHA accepted.
- SAE 100R1 Type AT, EN 853 Type 1SN.
- ISO 1436a.

CONSTRUCTION:

» Inner Tube: Nitrile
» Reinforcement: One steel braid
» Cover: Vinyl nitrile

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
92607	H19016	1"	1-13/32	1,275 psi	5,100 psi	12"	50	Z-Series on page H17

REFRIGERANT HOSE

H757 AIR CONDITIONING HOSE

- For use with Freon R12 or R134a air conditioning and refrigeration lines.
- Meets or exceeds SAE J2064 Type C Class 1.
- Superior resistance to moisture.
- Temperature range: -22° F to 257° F (-30° C to 125° C)
- Special H757 collets required.

CONSTRUCTION:

» Inner tube: Rubber/nylon/rubber
» Reinforcement: One fiber braid
» Cover: Butyl (perforated)

Part No.	Cross Reference	Hose I.D.	O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
93700	H75706	5/16	9/16	400 psi	2,000 psi	2"	50	E-Series 757 Air Conditioning Hose Ends on page H11
93701	H75708	13/32	11/16	400 psi	2,000 psi	2-1/2	50	
93702	H75710	1/2	3/4	350 psi	1,750 psi	3"	50	
93703	H75712	5/8	15/16	350 psi	1,750 psi	4"	50	

GH134W MULTI-REFRIGERANT HOSE

- Compatible with the following refrigerants: R-12, R-22, R-134a, R-502, MP39, MP66, R404a and R407c
- Provides excellent effusion resistance and maximum resistance to moisture. Extended service performance and superior flexibility.
- Compatible lubricants mineral oil, PAG and ester oil.
- Meets SAE J2064 Type E Class 1 requirements.
- Temperature range: -40° F to 257° F (-40° C to 125° C)

CONSTRUCTION:

» Inner tube: Polyamide veneer
» Reinforcement: Stabilized synthetic braided
» Cover: Chlorobutyl rubber

Part No.	Cross Reference	Hose I.D.	Hose O.D.	Working Pressure	Minimum Burst Pressure	Minimum Bend Radius	Qty. Feet	Use With Hose Ends
293700	GH134-6WR50	5/16	37/64	500 psi	2,000 psi	2"	50	E-Z Clip Hose System™ on page H10
293701	GH134-8WR50	13/32	45/64	500 psi	2,000 psi	2-1/2	50	
293702	GH134-10WR50	1/2	25/32	500 psi	2,000 psi	3"	50	
293703	GH134-12WR50	5/8	63/64	500 psi	2,000 psi	4"	50	
293704	GH134-16WR50	7/8	1-11/50	500 psi	2,000 psi	7"	50	

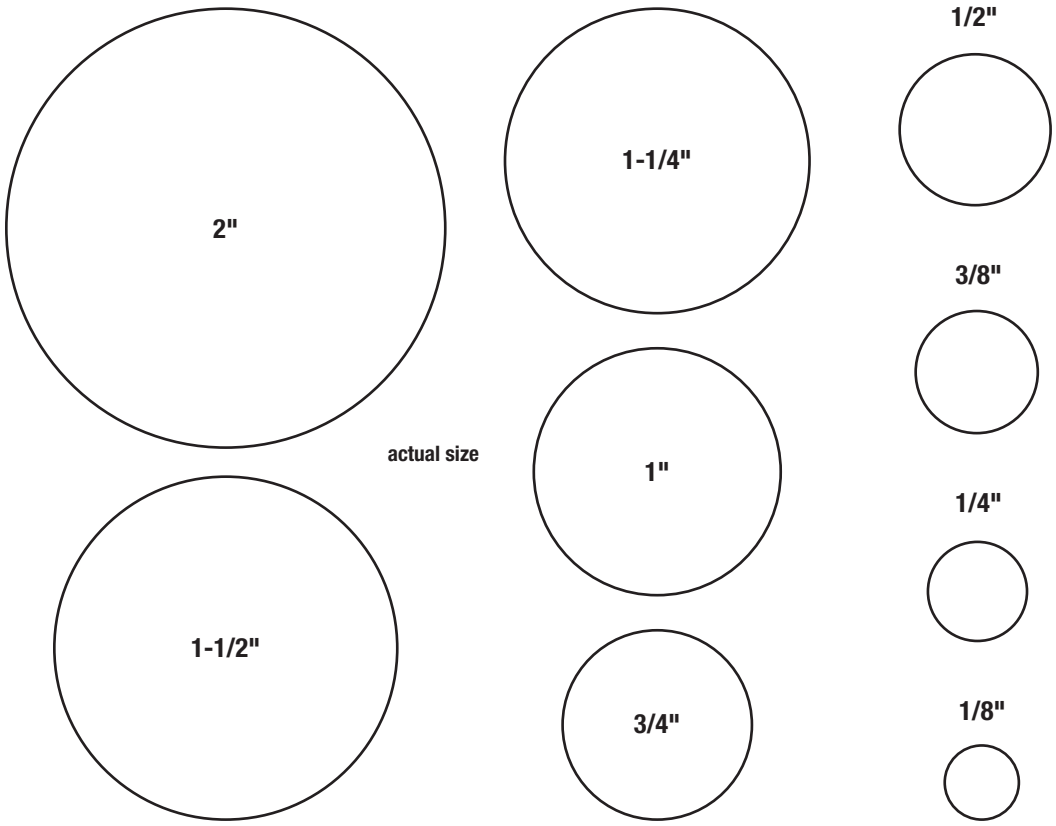
PIPE FITTING IDENTIFICATION CHART

CATEGORY	MATERIAL			
	Brass Pipe	Black Iron Pipe Schedule 40 Schedule 80	Galvanized Pipe Schedule 40	Steel Pipe

STYLE	STYLE OF FITTING					
	Union	90° Elbow	Coupling	90° Street Elbow	Nipple	Other

PIPE SIZE	DETERMINE THE PIPE THREAD

- Determine Pipe Thread by measuring across the threads and subtracting 1/4"
- Alternate Option: Measure using the diagram (below)



FINDING THE PART NO.	Brass Pipe	Black Iron Pipe Schedule 40	Black Iron Pipe Schedule 80	Galvanized Pipe Schedule 40	Steel Pipe
	F8-F9*	F12 - F13*	F14*	F12*	F15*

Take learned information and apply it to the corresponding catalog page. *Page numbers for Imperial Full-Line Catalog Volume 19.

FLARED FITTING IDENTIFICATION CHART

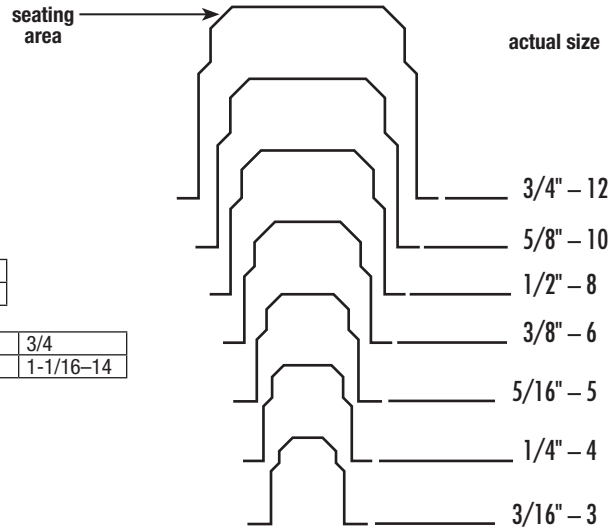
CATEGORY	MATERIAL	
	Brass SAE 45° Flared	Steel SAE 37° Flared

STYLE	STYLE OF FITTING					
	Union	90° Elbow	Coupling	90° Street Elbow	Nipple	Other

TUBE SIZE: BRASS 45° FLARED

DETERMINE TUBE SIZE FIRST

- **Determine 45° Tube Size using the diagram (right)**



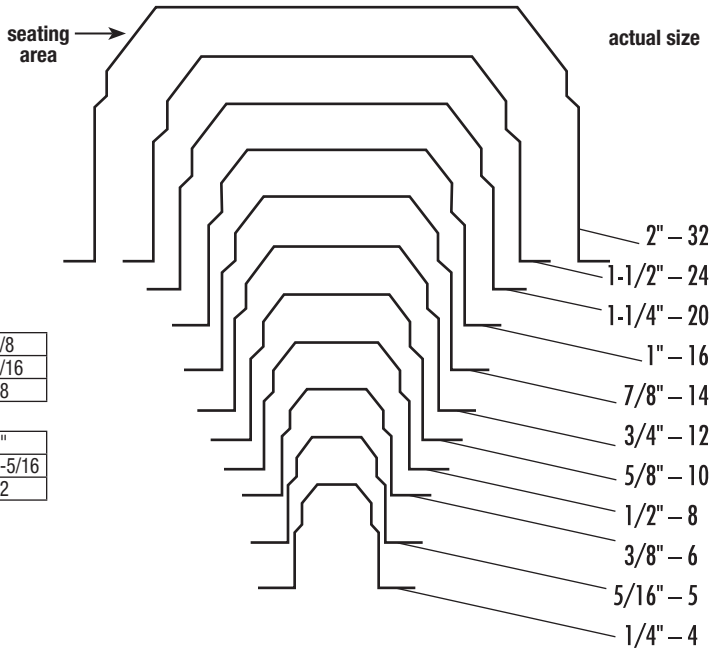
Tube O.D.	1/8	3/16	1/4	5/16
Thread Size	5/16–24	3/8–24	7/16–20	1/2–20

Tube O.D.	3/8	7/16	1/2	5/8	3/4
Thread Size	5/8–18	11/16–16	3/4–16	7/8–14	1-1/16–14

TUBE SIZE: STEEL 37° FLARED

DETERMINE TUBE SIZE FIRST

- **Determine 37° Tube Size using the diagram (right)**



Tube O.D.:	1/8	3/16	1/4	5/16	3/8
Thread Size:	5/16	3/8	7/16	1/2	9/16
Threads Per Inch:	24	24	20	20	18

Tube O.D.:	1/2	5/8	3/4	7/8	1"
Thread Size:	3/4	7/8	1-1/16	1-3/16	1-5/16
Threads Per Inch:	16	14	12	12	12

Tube O.D.:	1-1/4	1-1/2	2"
Thread Size:	1-5/8	1-7/8	2-1/2
Threads Per Inch:	12	12	12

PIPE SIZE	DETERMINE PIPE SIZE SECOND
	See Pipe Thread Diagram on Page 17

FINDING THE PART NO.	Brass SAE 45° Flared	Steel SAE 37° Flared
	F7*	F16 - F20*

Take learned information and apply it to the corresponding catalog page. *Page numbers for Imperial Full-Line Catalog Volume 19.

SPECIALTY FITTING IDENTIFICATION CHART

STYLE	DETERMINE STYLE OF FITTING								
	Straight Thread O-Ring Connector	90° Elbow	45° Elbow	Run Tee	Pipe Adapter	Plug	Union	Male Connector	Flat Face Fitting

STRAIGHT THREAD BOSS O-RING FITTING WITH 37° JIC FLARE

DETERMINE TUBE SIZE FIRST

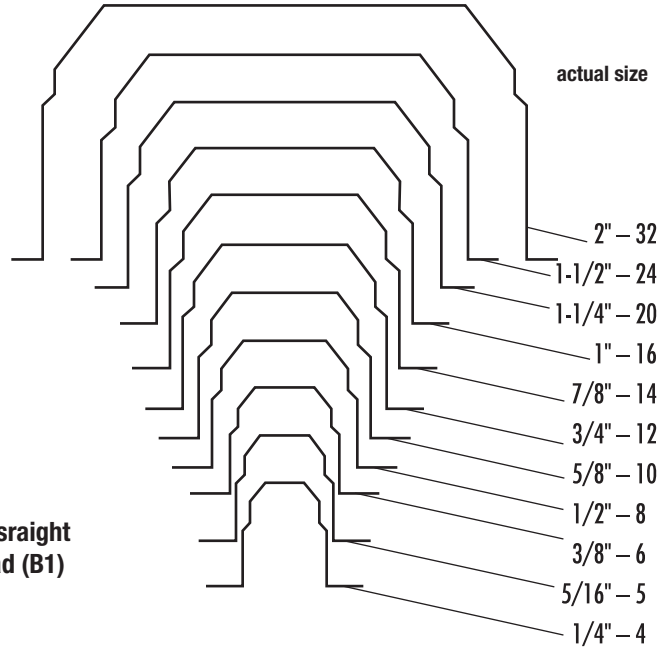
DETERMINE PORT SIZE SECOND

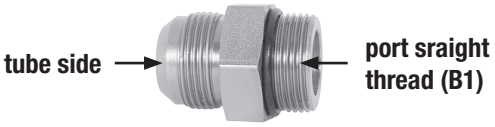
- **Determine 37° Tube Size using the diagram (right)**

Tube O.D.:	1/8	3/16	1/4	5/16	3/8
Thread Size:	5/16	3/8	7/16	1/2	9/16
Threads Per Inch:	24	24	20	20	18

Tube O.D.:	1/2	5/8	3/4	7/8	1"
Thread Size:	3/4	7/8	1-1/16	1-3/16	1-5/16
Threads Per Inch:	16	14	12	12	12

Tube O.D.:	1-1/4	1-1/2	2"
Thread Size:	1-5/8	1-7/8	2-1/2
Threads Per Inch:	12	12	12



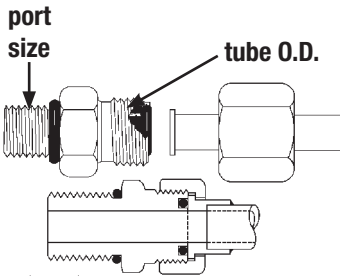


For-Seal / Flat Face

DETERMINE TUBE SIZE FIRST

DETERMINE PORT SIZE SECOND

Tube O.D.:	1/4	3/8	1/2	5/8	3/4	1"	1-1/4
FOR-SEAL® Thread:	9/16–18	11/16–16	13/16–16	1" –14	1-3/16–12	1-7/16–12	1-11/16–12
Max. Pressure:	6,000 psi	6,000 psi	6,000 psi	6,000 psi	6,000 psi	6,000 psi	4,000 psi
Adjust. Fitting psi:	6,000 psi	6,000 psi	6,000 psi	6,000 psi	6,000 psi	6,000 psi	4,000 psi
Port Size:	1/4	3/8	1/2	5/8	3/4	1"	1-1/4
Thread Size:	7/16–20	9/16–18	3/4–16	7/8–14	1-1/16–12	1-5/16–12	1-5/8–12



FINDING THE PART NO.	Straight Thread Boss O-Ring Fitting with 37° JIC Flare	Flat Face O-Ring Fittings
	PAGE F18*	PAGE F19 - F20*

Take learned information and apply it to the corresponding catalog page. *Page numbers for Imperial Full-Line Catalog Volume 19.

HYDRAULIC HOSE IDENTIFICATION CHART

Use only Weatherhead® Hose with Weatherhead® Hose ends.

CATEGORY	High Pressure Hose	Medium Pressure Hose	Low Pressure Hose	Truck Hydraulic Hose	Suction Hose
STYLE	H145 H425 H245 H430 H280 H470	H104 H435 H436	H100 H101 H201 H115	H213 H069 H569	H039

SIZE	Hose is measured on the Inside Diamger (ID)

	SPECIFICATIONS TO DETERMINE THE CORRECT HOSE
CHOOSING THE CORRECT HOSE	Inner Tube Material Number of Braids / Reinforcement Needed Bend Radius Temperature Rating Maximum Working Pressure SAE Requirements Outer Cover Materials

FINDING THE PART NO.	Hose Information / Data is stamped on the 'laid line' of the hose.

Do Not Engineer a Hose Assembly.

VII. FITTING IDENTIFICATION

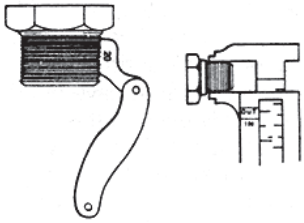
Fitting Thread Size Comparison Chart

The male connections have (Male unified thread class 2 fit) UN-2A specification threads and the female connections have (Female unified thread class 2 fit) UN-2B specification threads. The exceptions are male and female pipe threads.

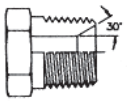
Tube Fittings

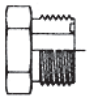
There are four basic types of tube fittings: Flare, Flareless, Straight Thread O-Ring, and Flat Face O-Ring Seal (FOR-SEAL™). Tube fittings seal in two ways. Flare and Flareless fittings use metal to metal contact joints. Straight Thread O-Ring and Flat Face O-Ring fittings use a rubber o-ring. Where extreme vibration is present, use Flareless, Straight Thread or Flat FaceO-Ring Seal fittings.

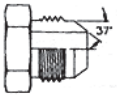
SIZING: For accuracy, it is recommended the male thread be measured. Measure the outside diameter. For our example use 7/16" Next measure the threads per inch – use 20. Our fitting size measures 7/16-20. Refer to the thread chart on this page for appropriate tube size and illustration.

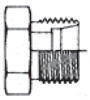


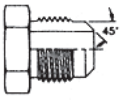
See page 384 for Thread Measuring Kits.

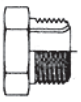












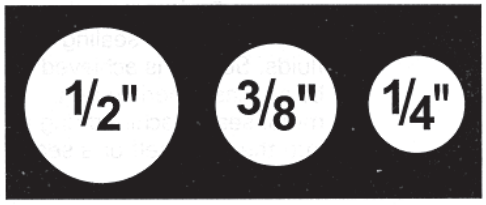
SIZE	PIPE	FOR-SEAL®	37° FLARE FLARE-TWIN®	ERMETO® 7000 SERIES	STRAIGHT THREAD O-RING SAE	45° FLARE	INVERTED FLARE
1/8	1/8-27	—	5/16-24	5/16-24	5/16-24	5/16-24	5/16-28
3/16	—	—	3/8-24	3/8-24	3/8-24	3/8-24	3/8-24
1/4	1/4-18	9/16-18	7/16-20	7/16-20	7/16-20	7/16-20	7/16-24
5/16	—	—	1/2-20	1/2-20	1/2-20	1/2-20	1/2-20
3/8	3/8-18	11/16-16	9/16-18	9/16-18	9/16-18	5/8-18	5/8-18
7/16	—	—	—	—	—	11/16-16	11/16-18
1/2	1/2-14	13/16-16	3/4-16	3/4-16	3/4-16	3/4-16	3/4-18
5/8	—	1-14	7/8-14	7/8-14	7/8-14	7/8-14	7/8-18
3/4	3/4-14	1-3/16–12	1-1/16–12	1-1/16–12	1-1/16–12	1-1/16–14	1-1/16–16
7/8	—	—	1-3/16–12	1-3/16–12	1-3/16–12	—	1-3/16–16
1	1–11-1/2	1-7/16–12	1-5/16–12	1-5/16–12	1-5/16–12	—	1-5/16–16
1 1/4	1-1/4–11-1/2	1-11/16–12	1-5/8–12	1-5/8–12	1-5/8–12	—	—
1 1/2	1-1/2–11-1/2	2-12	1-7/8–12	1-7/8–12	1-7/8–12	—	—
2	2–11-1/2	—	2-1/2–12	2-1/2–12	2-1/2–12	—	—
2 1/2	2-1/2–8	—	3-12	—	—	—	—
3	3-8	—	3-1/2–12	—	—	—	—

Pipe Fittings

The American Society of Automotive Engineers in cooperation with industry set up a standard for improvement in pipe threads. This improvement is known as the Dryseal Pipe Thread. All Weatherhead pipe threads are American Standard Taper Dryseal Pipe Threads (NPTF). The metal to metal seal is formed by contact at the thread crest and root.

Nominal pipe sizes do not agree with either the I.D., O.D., or thread sizes. To determine pipe size (up to 1-1/4") measure the diameter of the threads and subtract 1/4" For example, subtract 1/4" from a 1" pipe to obtain the nominal pipe size of 3/4".

Pipe sizes can also be given in 'dash numbers.' A dash number is always the numerator of an inch over 16th. For instance, if the pipe O.D. measures 1/2" that would be converted to 16ths (8/16), but be written as -8.



Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

FITTING IDENTIFICATION

Identifying metric, or non-USA, threaded connections is similar to identifying the connections that have been commonly used in the United States. The following text covers how to identify the different styles of metric connections offered by Eaton.

BSPP & BSPT Thread Chart

BSP Thread Size	1/8-28	1/4-19	3/8-19	1/2-14	5/8-14	3/4-14	1-11	1-1/4–11	1-1/2–11	2-11
Male Thread Diameter	9.72 (.375)	13.16 (.518)	16.66 (.656)	20.96 (.825)	22.91 (.902)	26.44 (1.041)	33.25 (1.309)	41.91 (1.650)	47.80 (1.882)	59.51 (2.347)
Female Thread Diameter	8.73 (.343)	11.66 (.459)	15.37 (.605)	18.90 (.744)	20.85 (.821)	24.38 (.960)	30.61 (1.205)	39.24 (1.545)	45.24 (1.781)	55.94 (2.242)
Pitch	.91 (.036)	1.34 (.053)	1.34 (.053)	1.81 (.071)	1.81 (.071)	1.81 (.071)	2.31 (.091)	2.31 (.091)	2.31 (.091)	2.31 (.091)

Figure 4a. Dimension Note: MM(IN)

Threads

The thread forms and their corresponding specifications listed below are used on all of the metric styles of connections which will be discussed later. These cover the basic forms of the threads but not the style of connection.

THREAD TYPE	SPECIFICATIONS
British Parallel Pipe Threads	BS 2779, ISO/R 228
British Taper Pipe Threads	BS 21, ISO/R 7
Metric Parallel Threads	DIN 3852, ISO/R 6149
Metric Taper Threads	DIN 3852

Note: **BS** British Standards Institution

ISO International Standards Organization

DIN Deutsche Industrie Norme

To identify metric connections, you will need instruments that can accurately measure thread inside and outside diameters, thread pitch and fitting seat angles. The TA-1002 Thread Measuring Guide and Tool Kit is a basic kit that will help you in identifying most of the connections you will be encountering on imported equipment.

Parallel Threads ('G')

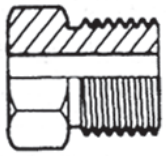


Figure 1.

apered Threads ('R')

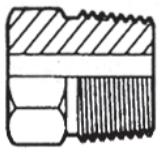


Figure 2.

Parallel and Tapered Threads

The first step in identifying thread forms is to determine if the thread is parallel or tapered. Parallel threads are not used for sealing fluids. Sealing is achieved by an elastomeric o-ring, metal seal, machined ring into the hex itself or a seat machined into the end of the fitting. This style is similar to straight thread o-ring port connections where the threads are used for retention of the sealing method against a machine port. Parallel threads can be determined by laying a straight edge along the threads. If the threads are parallel to the center line of the fitting, then the fitting has parallel threads. See Figure 1.

Tapered threads seat by the interference caused by the male and female threads. These threads create a pressure-tight joint by metal deformation when they are tightened. Sealants on the threads are commonly used in this style of connection. Laying a straight edge on the threads, compare this line with the center line of the fitting. If this line tapers slightly away from the center line, then the threads are tapered. See Figure 2.

British Pipe Threads

There are two forms of British Standard Pipe Threads that are used in the world today. They are BSPP (British Standard Pipe Parallel) and BSPT (British Standard Pipe Tapered). The BSPT male thread mates with the female BSPT thread similar to an NPTF connection. The 30° BSPP male adapters connect to a female BSPP thread with a 30° cone. This style is comparable to an NPSM swivel style. These threads are almost identical to the NPTF Pipe Thread except for the flank angle. This angle is 55° versus 60° on the NPTF. See Figure 3. Because of this difference, the two forms are NOT interchangeable.

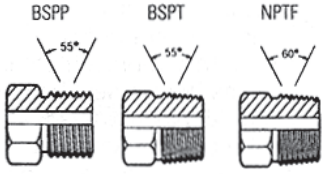


Figure 3.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

FITTING IDENTIFICATION

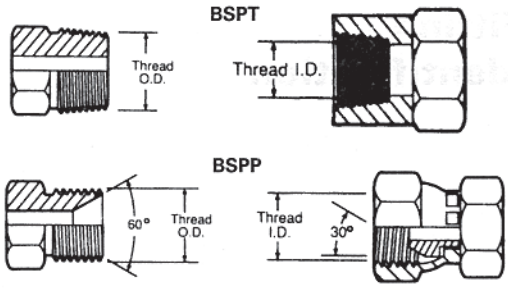


Figure 4.

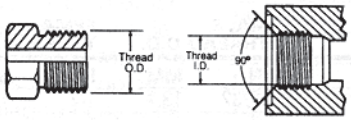
Identifying BSP threads starts with determining if it is a parallel or tapered thread. Next, referencing Figure 4 and 4a, measure the lead thread diameter. Compare this measurement to the listed dimensions to determine size. If instruments are not available to measure this, you can compare it end-to-end with a known NPTF thread to approximately arrive at the nominal BSP size. Finally, measure the pitch and compare it to the chart on Figure 4 to complete the identification. These dimensions will be the same for both BSPP and BSPT.

Metric Threads

Metric threads are similar to inch-sized threads except for the sizing which is based on standard metric units. Identifying metric threads starts with determining if it is a parallel or tapered thread. Next, measure the thread diameter. Compare this measurement to the dimensions listed in Figure 5 to determine size. Finally, measure the pitch and compare to chart. These dimensions will be common for both parallel and tapered threads.

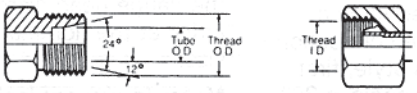
DIN 3901/3902L, 3901/3902S

The most popular metric flareless, or bite-type, fitting style is the 24° Metric Tube Seat. This style incorporates a tapered seat in the fitting body with a bite-type sleeve, or ferrule, for the connection. When the nut is tightened, the tapered seat forces the sleeve into the tube creating a positive seal. This style of connection is available in both a Light and Heavy series and is designed for medium and high pressure applications respectively. The two series have different parallel thread sizes in relationship to the nominal tube outside diameter, but share a common sleeve. This style can be identified by the combination of the 24° internal seat and a male metric parallel thread. The series can be determined by measuring the seat counterbore, which is the approximate tube outside diameter, and comparing it to the thread size. Compare these di-mensions to those shown in Figure 6 to determine the series. The nominal sleeve size is taken directly from the tube outside diameter dimension.



METRIC THREAD SIZE	MALE THREAD DIAMETER		FEMALE THREAD DIAMETER		PITCH	
	MM	IN	MM	IN	MM	IN
M10 x 1.0	10.0	.394	8.5	.335	1.0	.039
M12 x 1.5	12.0	.472	10.5	.413	1.5	.059
M14 x 1.5	14.0	.551	12.5	.492	1.5	.059
M16 x 1.5	16.0	.630	15.5	.610	1.5	.059
M18 x 1.5	18.0	.709	16.5	.650	1.5	.059
M20 x 1.5	20.0	.787	18.5	.728	1.5	.059
M22 x 1.5	22.0	.866	20.5	.807	1.5	.059
M24 x 1.5	24.0	.945	22.5	.886	1.5	.059
M26 x 1.5	26.0	1.024	24.5	.964	1.5	.059
M27 x 2.0	27.0	1.063	25.5	1.004	2.0	.079
M30 x 2.0	30.0	1.181	28.5	1.122	2.0	.079
M33 x 2.0	33.0	1.299	31.5	1.240	2.0	.079
M36 x 2.0	36.0	1.417	34.5	1.358	2.0	.079
M42 x 2.0	42.0	1.653	40.5	1.594	2.0	.079

Figure 5.



TUBE O.D.		NOM. O.D.	SERIES–THREAD	
MM	IN	(MM)	LIGHT - l.Rh.	HEAVY - s.Rh.
8	.315	8	M14 x 1.5	M16 x 1.5
10	.394	10	M16 x 1.5	M18 x 1.5
12	.472	12	M18 x 1.5	M20 x 1.5
14	.551	14	—	M22 x 1.5
15	.591	15	M22 x 1.5	—
16	.630	16	—	M24 x 1.5
18	.709	18	M26 x 1.5	—
20	.787	20	—	M30 x 2.0
22	.866	22	M30 x 2.0	—
25	.984	25	—	M36 x 2.0
28	1.102	28	M36 x 2.0	—
30	1.181	30	—	M42 x 2.0

Figure 6.

See page 384 for Thread Measuring Kits.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

VIII. SIX STEP METHOD

CUT— Cut the hose clean and square at both ends. This needs to be done to ensure proper connection at the hose end. Use of non-fiber, cut-off blades are recommended. Stainless steel is preferred.

CLEAN— Clean the internal tube area to remove any contamination. Blow air thru the tube using your shop air hose if necessary.

CONNECT— When making the connection, make sure all components are clean from dirt, oils, and other contaminant. Crimping the hose ends require the use of proper tools and proper settings on the machines. Do not exceed manufacturers specifications.

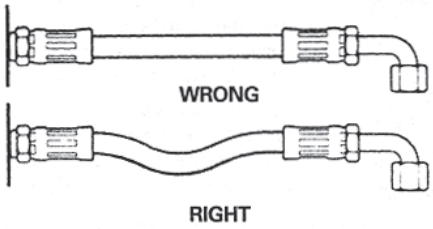
PROTECT— It is important to use the proper protection on the hoses. This will ensure the hose will not fail due to chafing.

SECURE— Always secure the hose to prevent it from vibration and the problems resulting from vibration. Use tube clamps, hose separator clamps, or black nylon cable ties to minimize vibration and provide longer hose life.

IDENTIFY— Proper identification will make the job easier if you or others need to inspect the hose somewhere down the road.

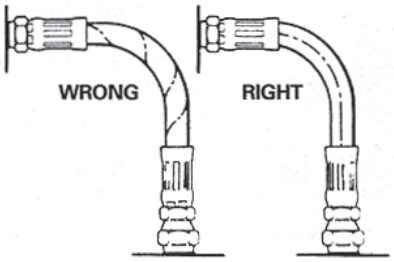
IX. HOSE INSTALLATION

1. Provide for length change.



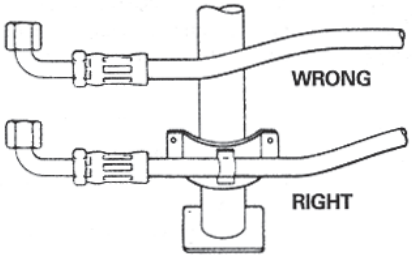
In straight hose installations, allow enough slack in the hose line to provide for changes in length that will occur when pressure is applied. This change in length can be from +2% to -4%.

2. Avoid twisting and orient properly.



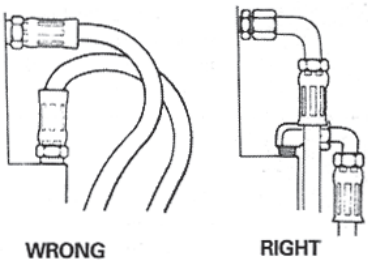
Do not twist hose during installation. This can be determined by the printed layline on the hose. Pressure applied to a twisted hose can cause hose failure or loosening of connections.

3. Protect from hazardous environment.



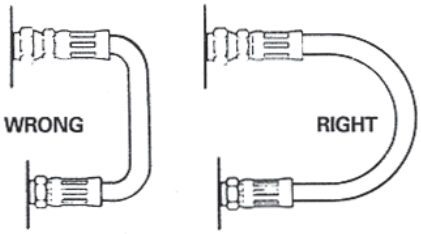
Keep hose away from hot parts. High ambient temperature will shorten hose life. If you can not route it away from the heat source, insulate it. (See Spring Guards page 66-76.)

4. Avoid mechanical strain.



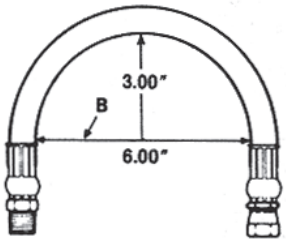
Use elbows and adapters in the installation to relieve strain on the assembly and to provide easier and neater installations that are accessible for inspection and maintenance.

5. Use proper bend radius.



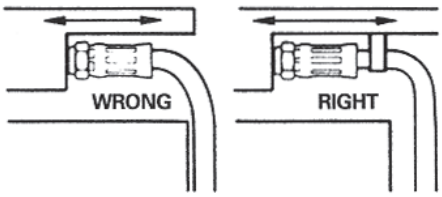
Keep the bend radius of the hose as large as possible to avoid collapsing of the hose and restriction of flow. Follow catalog specs on minimum bend radii.

6. Use proper bend radius (cont'd).



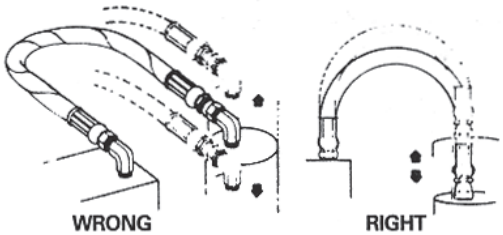
Minimum bend radius is measured on the inside bend of the hose. To determine minimum bend, divide the total distance between ends (B length) by 2. For example, B = 6, minimum bend radius = 3.

7. Secure for protection.



Install hose runs to avoid rubbing or abrasion. Use Weatherhead Hose Clamps to support long runs of hose or to keep hose away from moving parts. It is important that the clamps not allow the hose to move. This movement will cause abrasion and premature hose failure. (See Hose Clamps pg 83.)

8. Avoid improper hose movement.



Make sure relative motion of the machine components produces bending rather than twisting of the hose. Hose should be routed so that the flex is in the same plane as the equipment movement.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

Refer to safety information regarding Coll-O-Crimp® hose installation on page 22.

X. EQUIPMENT

Coll-O-Crimp® T-400 Crimping Procedure

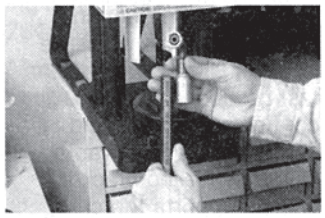
NOTE: Different models of machines may have slightly different crimping procedures. Consult your owners manual or the Weatherhead Catalog for correct crimping procedures and tool dies.

EXAMPLE ONLY:

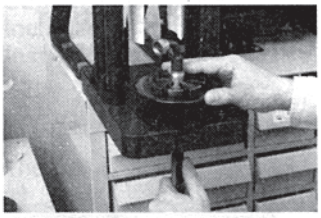
⚠ WARNING

You must hold the hose assembly in place from below throughout the crimping operation. Do not place fingers or hands at the crimping point during operation. Failure to follow this procedure could result in serious injury to your hand or finger.

1. Place die ring **T-400-8** on base plate against front stops.
2. Insert properly-sized matched collet halves in the die ring. See chart on press.

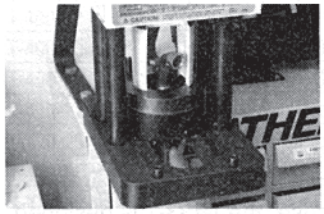


3. Place the correct Coll-O-Crimp hose end on hose. Be sure hose is bottomed in hose end.

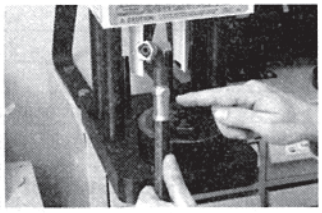


4. Insert hose assembly from below between the collet halves. Align the dimples on the hose end collar with the top of the collet. When crimping 229 'P', 265 'P', or 338 'P' or 757 'E' Series ends, the collar should be flush with the top of the collet.

5. Place specified side of spacer ring face down on collet with uncrimped hose assembly held in place. Refer to the Hose End & Tool Selection Chart in the back of this catalog for further instruction.
6. Slide entire assembly back against rear locating stops.



7. Activate pump to crimp hose end to hose. When spacer ring contacts die ring, crimping is complete. Release the electric switch to retract pusher. Slide entire assembly forward and remove spacer ring.



8. Remove factory-quality crimped hose assembly and visually inspect the crimped end. The crimp on the collar should be located ± 1/16" from the dimples or ridges.
9. To insure a proper crimp has been completed, measure the nominal crimp diameter. Refer to Hose End and Tool Selector Chart in back of catalog for procedure and crimp diameters.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003

XI. IMPORTANT SAFETY INFORMATION

⚠ **WARNING!**

Selection of Hose

Selection of the proper Weatherhead hose for the application is essential to the proper operation and safe use of the hose and related equipment. Inadequate attention to selection of the hose for your application can result in hose leakage, bursting, or other failure which can cause serious bodily injury or property damage from spraying fluids or flying projectiles. In order to avoid serious bodily injury or property damage resulting from selection of the wrong hose, you should carefully review the information in this catalog. Some of the factors which are involved in the selection of the proper hose are:

- hose size
- hose length
- hose ends
- material conveyed
- bends
- temperature
- hose pressure
- static head pressure
- installation design

These factors and the other information in this catalog should be considered by you in selecting the proper hose for your application.

If you have any questions regarding the proper hose for your application, please contact Eaton Technical Support at 1-888-258-0222.

Proper Selection of Hose Ends

Selection of the proper Weatherhead end fittings for the hose end application is essential to the proper operation and safe use of the hose and related equipment. Inadequate attention to the selection of the end fittings for your application can result in hose leakage, bursting, or other failure which can cause serious bodily injury or property damage from spraying fluids or flying projectiles. In order to avoid serious bodily injury or property damage resulting from selection of the wrong end fitting, you should carefully review the information in this catalog. Some of the factors which are involved in the selection of the proper hose ends are:

- fluid compatibility
- temperature
- installation design
- hose size
- corrosion requirements
- material conveyed

These factors and the other information in this catalog should be considered by you in selecting the proper hose end fittings for your application.

If you have any questions regarding the proper hose for your application, please contact Eaton Technical Support at 1-888-258-0222.

Hose Installation

Proper installation of the hose is essential to the proper operation and safe use of the hose and related equipment. Improper installation of the hose can result in serious injury or property damage caused by spraying fluids or flying projectiles. In order to avoid serious bodily injury or property damage resulting from improper installation of the hose, you should carefully review the information in this catalog regarding hose installation. Some of the factors you must consider in installing the hose properly are:

- changes in length
- proper bend radius
- protection from high temperature sources
- elbows and adapters to relieve strain
- rubbing or abrasion
- twisting
- improper hose movement

These factors and the other information in this catalog regarding hose installation should be considered by you before installing the hose.

If you have any questions regarding proper hose installation, please contact Eaton Technical Support at 1-888-258-0222.

Hose Maintenance

Proper maintenance of the hose is essential to the safe use of the hose and related equipment. Hose should be stored in a dry place. Hose should also be visually inspected. Any hose that has a cut or gouge in the cover that exposes the reinforcement should be retired from service. Hoses should also be inspected for kinking or broken reinforcement. If the outside diameter of the hose is reduced by 20% at the spot where it is bent then the hose should be retired from service. Inadequate attention to maintenance of the hose can result in hose leakage, bursting, or other failure which can cause serious bodily injury or property damage from spraying fluids, flying projectiles, or other substances.

Hose and Field Attachable Hose Ends

Weatherhead Hose and Field Attachable Hose Ends have been engineered and designed as a complete hose assembly system. Component compatibility along with the use of quality components insures the production of reliable hose assemblies when assembled properly. The use or intermixing of ends and hose not specifically engineered and designed for use with each other may result in the production of unsafe or unreliable hose assemblies. This can result in hose assembly leakage, hose separation or other failures which can cause serious bodily injury or property damage from spraying fluids, flying projectiles, or other substances. The Eaton warranty is limited to apply only when Weatherhead Field Attachable Hose Ends are used on compatible Weatherhead hose. See back inside cover for warranty information.

Coll-O-Crimp® Hose, Hose Ends and Assembly Equipment Compatibility

The Coll-O-Crimp® Equipment Package, Coll-O-Crimp Hose Ends and Coll-O-Crimp Hose have been engineered and designed as a complete hose assembly system. Each component of the Coll-O-Crimp hose assembly system is compatible with other Coll-O-Crimp components to which it relates. Component compatibility, along with the use of quality components, insures the production of reliable hose assemblies when assembled properly. The use or intermixing of fittings and hose not specifically engineered and designed for use with each other and Coll-O-Crimp equipment is not recommended and may result in the production of unsafe or unreliable hose assemblies. This can result in hose assembly leakage, hose separation or other failures which can cause serious bodily injury or property damage from spraying fluids, flying projectiles, or other substances. The Eaton warranty is limited to apply only when Coll-O-Crimp Hose Ends and compatible Coll-O-Crimp Hose are used with Coll-O-Crimp assembly equipment.

Source: **EATON Weatherhead** Hose Assembly Master Catalog W-HYOV-MC002-E November 2003