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NAVFAC IGS-15211 (FEBRUARY 2003)  
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Preparing Activity: LANTNAVFACENGCOM Based on UFGS-15211

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

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SECTION 15211

LOW PRESSURE COMPRESSED AIR PIPING (NON-BREATHING AIR TYPE)  
02/03

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NOTE: This guide specification is issued by the  
Atlantic Division, Naval Facilities Engineering  
Command for regional use in Italy.

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NOTE: This guide specification covers requirements  
for non-breathing air compressed air systems inside  
of buildings with pressures up to 862 kPa (gage).  
Project requirements may require supplemental  
information added to the paragraphs contained herein.

Comments and suggestion on this specification are  
welcome and should be directed to the technical  
proponent of the specification. A listing of the  
technical proponents, including their organization  
designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer  
choices or locations where text must be supplied by  
the designer.

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the  
extent referenced. The publications are referred to in the text by the  
basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 520 (1990) Positive Displacement Refrigerant  
Compressors, Compressor Units and  
Condensing Units

ASME INTERNATIONAL (ASME)

ASME/ANSI B16.5 (1996) Pipe Flanges and Flanged Fittings

ASME/ANSI B16.9 (2001) Factory-Made Wrought Steel  
Buttwelding Fittings

ASME B16.11 (2001) Forged Fittings, Socket-Welding and  
Threaded

ASME/ANSI B16.24 (2001) Cast Copper alloy Pipe Flanges and  
Flanged Fittings Class 150, 300, 400, 600,  
900, 1500, and 2500

ASME/ANSI B16.34 (1996) Valves - Flanged, Threaded, and  
Welding End

ASME B31.1 (2001) Power Piping

ASME/ANSI B40.100 (1998) Pressure Gauges and Gauge  
Attachments

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1996) Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated Welded and Seamless

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

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**NOTE: An ISO Standard is published by the  
International Standard Organization which is a  
worldwide federation of national standards bodies  
from 120 countries. ISO standards cover all fields  
except electric and electronical engineering  
standards. ISO's are available in both English  
and French language.**

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ISO 5390 (1997) Compressors - Classification

ISO 8010 (1988) Compressors for the process  
industry - Screw and related types -  
Specifications and data sheets for their  
design and construction

ISO 8012 (1988) Compressors for the process  
industry - Reciprocating types -  
Specifications and data sheets for their  
design and construction

ITALIAN LAWS AND NORMS (D.M.)(LAW)(CIRC.)

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**NOTE: Italian laws and normatives are the legislative regulations and decrees issued by the Italian government in the form of laws, norms, decrees, circulars, and letters. These Laws and Decrees concur together with Norms and Standards in forming the governing directives for construction.**

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- Law 46 (5/3/1990) Regulations for safety of systems
- D.L. 93 (25/2/2000) Accomplishment of EEC Directive 97/23/CE in matter of pressure equipment
- D.L. 242 (19/03/1996) Modification and Integration to D.L. 626/94
- D.L. 494 (14/8/1996) Implementation of the instruction 92/57/CEE concerning the minimum safety and health requirements to be accomplished in temporary or mobile work site
- D.P.R. 547 (27/4/1955) Regulations for work accident prevention
- D.L. 626 (19/9/1994) Implementation of EEC directives, 89/391/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE and 90/679/CEE, concerning improvement of safety and health of workers in the working place

ITALIAN NATIONAL ASSOCIATION FOR UNIFICATION OF STANDARDS (UNI)

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**NOTE: A UNI Norm is a technical normative recognized as Italian Law, submitted by a private organization "Ente Nazionale Italiano di Unificazione" for Italy and is available only in the Italian language. It is the National Standard.**

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- UNI 2059 (1942) Gaskets for pipe flanges and for valve stuffing boxes
- UNI 2223 (1967) Metallic pipe flanges - Templates for drilling circular flanges
- UNI 2278 (1967) Metallic pipe flanges - Circular slip-on-welding flanges - Nominal pressure

- UNI 4648 (1961) Multiple thread cutters - Metric thread cutting
- UNI 5311 (1963) Gripping and holding appliances - Straps, clamps, squares and bearings - Summary of standard types
- UNI 4668 (1961) Pressure and vacuum gages - Cock with 1/2 gas connection and connection for control device
- UNI 5634 (1997) Identification systems for pipelines and canalizations conveying fluids
- UNI 6609 (1969) Metallic pipe flanges - Bolts - Types, materials and ratings
- UNI 6884 (1987) Shutting and regulation valves for fluids - Supply and test conditions
- UNI 7145 (1972) Pipe clamps for use on board ships - Summary of standard types
- UNI 8863/FA-1 (1987/89) Unalloyed steel seamless and welded tubes suitable for screwing in accordance with UNI ISO 7/1
- UNI 9335 (1991) Safety valves - General requirements
- UNI 10284 (1993) Monolithic insulation joints. 10 Š DN Š 80 - PN 10
- UNI 10285 (1993) Monolithic insulation joints. 80 Š DN Š 600 - PN 16

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN)  
(UNI EN ISO)(UNI ISO)

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**NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.**

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- UNI ISO 7-1 (1984) Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation

UNI EN 837-1	(1998) Pressure gauges - Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing
UNI EN 837-2	(1998) Pressure gauges - Selection and installation recommendations for pressure gauges
UNI EN 837-3	(1998) Pressure gauges - Diaphragm and capsule pressure gauges - Dimensions, metrology, requirements and testing
UNI EN 1057	(1997) Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications
UNI EN 1044	(2001) Brazing - Filler metals
UNI EN 1074-3	(2001) Valves for water supply - Fitness for purpose requirements and appropriate verification tests - Part 3: Check valves
UNI EN 1254-1	(2000) Copper and copper alloys - Plumbing fittings - Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes
UNI EN 1254-2	(2000) Copper and copper alloys - Plumbing fittings - Part 2: Fittings with compression ends for use with copper tubes
UNI EN 1254-3	(2000) Copper and copper alloys - Plumbing fittings - Part 3: Fittings with compression ends for use with plastic pipes
UNI EN 1254-5	(2000) Copper and copper alloys - Plumbing fittings - Part 5: Fittings with short ends for capillary brazing to copper tubes
UNI EN 1515-1	(2002) Flanges and their joints - Bolting - Part 1: Selection of bolting
UNI EN 1567	(2002) Building valves - Water pressure reducing valves and combination water pressure reducing valves - Requirements and tests
UNI EN 10216-1	(2002) Seamless steel tubes for pressure purposes - Technical delivery conditions - Non-alloy steel tubes with specified room temperature properties
UNI EN 10242/A1	(2001/01) Threaded pipe fitting in

malleable cast iron

- UNI EN 10253-1 (2002) Butt-welding pipe fittings - Part 1: Wrought carbon steel for general use and without specific inspection requirements
- UNI EN 12449 (2001) Copper and copper alloys - Seamless, round tubes for general purposes
- UNI EN ISO 13920 (2000) Welding - General tolerances for welded constructions - Dimensions for lengths and angles - Shape and position
- UNI EN 26704 (1992) Automatic steam traps - Classification
- CEI EN 50298 (1999) Empty enclosures for low-voltage switchgear and controlgear assemblies - General requirements
- CEI EN 60034-1 (2000) Rotating electrical machines - Part 1: Rating and performance
- CEI EN 60947-4-1 (2002) Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters

PLUMBING AND PIPING INDUSTRY COUNCIL (PPIC)

- PPIC GFSR (1982) Guidelines for Seismic Restraints (GFSR) of Mechanical Systems and Plumbing Piping Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

- SMACNA SRM (1998) Seismic Restraint Manual Guidelines for Mechanical Systems

1.2 RELATED REQUIREMENTS

Section 15050, "Basic Mechanical Materials and Methods," applies to this section, with the additions and modifications specified herein.

1.3 SUBMITTALS

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**NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically**

significant to merit approval by the Government.  
Submittal items not designated with a "G" will be  
approved by the QC organization.

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Submit the following in accordance with Section 01330, "Submittal  
Procedures."

SD-03 Product Data

Air compressor

Air Dryer

Air receiver

Desiccant air dryers

Desiccant

Pipe

Fittings

Valves

Pressure gages

Hangers and supports

Quick disconnect couplings

Filters

Strainers

Traps

Lubricators

Flexible connections

Dielectric unions

Hose reel assembly

Valve box

Identification labels for piping

Tubing

For receivers, include Manufacturer's Data Report Form U-1 or U-1A

SD-06 Test Reports

Leak tightness tests; G

SD-07 Certificates

Employer's record documents; G

Welding procedures and qualifications; G

SD-08 Manufacturer's Instructions

Air receiver

Include manufacturer's recommended certification test procedure and recommended procedure for cleaning, external painting, and delivery preparation.

SD-10 Operation and Maintenance Data

Air compressor, Data Package 4

Air dryer, Data Package 4

Submit in accordance with Section 01781, "Operation and Maintenance Manuals."

SD-11 Closeout Submittals

Posted operating instructions for air compressor

Posted operating instructions air dryer

1.4 QUALITY ASSURANCE

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**NOTE: The SMACNA SRM (seismic restraint manual) referenced in the paragraph below shall be applied to locations subject to significant risk of seismic induced loads. The degree to which this manual is to be used for contract drawings and specifications shall be determined by the designer of record in coordination with the NAVFAC Engineering Field Division's Mechanical Design Branch.**

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Provide work specified in this section, including design, materials, fabrication, assembly, erection, installation, and examination, inspection and testing of compressed air systems in conformance with Law 46, ASME B31.1, D.L. 93, and SMACNA SRM, as modified and supplemented by this specification section and accompanying drawings. In ASME B31.1, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" and "owner" shall be interpreted to mean the

Contracting Officer.

#### 1.4.1 Welding Procedure Qualifications

Provide all welding work specified in this section for compressed air piping systems in conformance with ASME B31.1, as modified and supplemented by this specification section and accompanying drawings. The welding work includes, but is not limited to, qualification of welding procedures, brazing procedures, welders, brazers, welding operators, brazing operators, inspection personnel, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

##### 1.4.1.1 Butt Welded Joints

Butt welded joints shall be full penetration joints.

#### 1.4.2 Employer's Record Documents

Submit to the Contracting Officer for his review and approval the following documentation. This documentation and the subject qualification shall be in compliance with ASME B31.1.

- a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.
- b. List of qualified welders and welding operators that are proposed to be used to provide the work specified in this specification section.
- c. List of qualified weld inspection personnel that are proposed to be used to provide the work specified in this specification section.

#### 1.4.3 Welding Procedures and Qualifications

- a. Specifications and Test Results: Submit copies of the welding procedure specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds.
- b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

#### 1.4.4 Equipment Data

Submit the following data for equipment listed for "Operation and

Maintenance Instructions, Parts and Testing."

- a. Name and address of authorized branch or service department.
- b. Characteristic curves.
- c. Following applicable data completely filled in:

Manufacturer and model number [\_\_\_\_\_]

Operating speed [\_\_\_\_\_]

Capacity [\_\_\_\_\_ (CMS)]

Type of bearings in unit [\_\_\_\_\_]

Type of lubrication [\_\_\_\_\_]

Type and adjustment of drive [\_\_\_\_\_]

Capacity of tank [\_\_\_\_\_]

Electric motor: Manufacturer, frame and type [\_\_\_\_\_]

Motor speed [\_\_\_\_\_] rad/sec

Current characteristics and kW of motor [\_\_\_\_\_]

[\_\_\_\_\_] Thermal cut-out switch: Manufacturer, type and model [\_\_\_\_\_]

Starter: Manufacturer: Type and model [\_\_\_\_\_]

1.5 SAFETY PRECAUTIONS

1.5.1 Temperature Restriction

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**NOTE: The designer shall assure that the piping design temperature is not exceeded, especially for high pressure systems. Provide aftercoolers and high temperature shutdown devices as required for safe operation of the systems.**

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Compressors or other equipment shall not discharge compressed air to the piping systems above [38] [\_\_\_\_\_] degrees C unless approved by the Contracting Officer. Aftercoolers or other devices shall be provided to comply with the temperature restriction.

1.5.2 Rotating Equipment

Fully guard couplings, motor shafts, gears and other exposed rotating or rapidly moving parts in accordance with D.P.R. 547, D.L. 626, and D.L. 242.

Provide rigid and suitably secured guard parts readily removable without disassembling guarded unit.

### 1.5.3 Welding and Brazing

Safety in welding, cutting, and brazing of pipe shall conform to D.P.R. 547, D.L. 626, D.L. 242, and D.L. 494.

## PART 2 PRODUCTS

### 2.1 SOURCE MANUFACTURERS

#### 2.1.1 Air Compressors, 7.5 to 224 KW

The following manufacturers provide low pressure air compressor units of 7.5 to 224 KW size that generally comply with these specifications:

BOGE ITALIA Srl  
Via Antonio Canova, 37  
20145 Milano  
Tel: 02-3453-7487  
Fax: 02-3453-2120  
www.boge.de

BALMA products  
ABAC ARIA COMPRESSA S.p.A.  
Via Einaudi, 6  
10070 Robassomero (TO)  
Tel: 011-924-6400  
Fax: 011-924-1096  
www.abacgroup.com

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

#### 2.1.2 Air Compressors, less than 7.5 KW

The following manufacturers provide low pressure air compressor units of less than 7.5 KW size that generally comply with these specifications:

ABAC Aria Compressa S.p.A.  
Via Einaudi, 6  
10070 Robassomero (YO)  
Tel: 011-9246400  
Fax: 011-9241096  
www.abacgroup.com

IMSYSTEM  
Via Palermo, 6  
09023 Monastir (CA)

Tel: 070-9177558  
Fax: 178-2207119  
www.imsystem.com

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

INGERSOLL-RAND ITALIANA S.p.A.  
Strada Cassanese  
20060 Vignate  
Tel: 02-950-561  
Fax: 02-953-60159

WORTHINGTON S.p.A.  
Flowserve Corporation  
Via Rossini, 90/92  
20033 Desio - Milano  
Tel: 0362-6121  
Fax: 0362-303396  
www.flowserve.com

#### 2.1.3 Air Receivers

The following manufacturers provide low pressure air receiver units that generally comply with these specifications:

AIRTEC  
Via Torquato Tasso, 13  
24020 Gorle (BG)  
Tel: 035-655988  
Fax: 035-669112  
www.airtecariacompressa.com

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

HIROSS S.p.A.  
via Leonardo da Vincci, 8  
35028 Piove di Sacco (PD)  
Tel: 049-9719212  
Fax: 049-9719317  
www.hiross.com

#### 2.1.4 Compressed Air Dryers

The following manufacturers provide low pressure compressed air dryer

equipment that generally complies with these specifications:

FRIULAIR DRYERS  
Via Cisis, 36 S.S. 352 km 21  
33050 Cervignano del Friuli (UD)  
Fraz. Strassoldo  
Tel: 0431-939416  
Fax: 0431-939419  
www.friulair.com

ALC snc  
Via Vigano de Vizzi, 64  
20092 Cinisello Balsamo (MI)  
Tel/Fax: 02-612-6316  
www.alc-ceccato.it

HIROSS S.p.A.  
via Leonardo da Vincci, 8  
35028 Piove di Sacco (PD)  
Tel: 049-9719212  
Fax: 049-9719317  
www.hiross.com

WORTHINGTON S.p.A.  
Flowserve Corporation  
Via Rossini, 90/92  
20033 Desio - Milano  
Tel: 0362-6121  
Fax: 0362-303396  
www.flowserve.com

#### 2.1.5 Chilled Water Type Compressed Air Dryers

The following manufacturers provide low pressure compressed air dryers for chilled water type systems that generally comply with these specifications:

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

FRIULAIR DRYERS  
Via Cisis, 36 S.S. 352 km 21  
33050 Cervignano del Friuli (UD)  
Fraz. Strassoldo  
Tel: 0431-939416  
Fax: 0431-939419  
www.friulair.com

HIROSS S.p.A.  
via Leonardo da Vincci, 8  
35028 Piove di Sacco (PD)

Tel: 049-9719212  
Fax: 049-9719317  
www.hiross.com

WORTHINGTON S.p.A.  
Flowserve Corporation  
Via Rossini, 90/92  
20033 Desio - Milano  
Tel: 0362-6121  
Fax: 0362-303396  
www.flowserve.com

#### 2.1.6 Desiccant Air Dryers

The following manufacturers provide desiccant air dryers for compressed air systems that generally comply with these specifications:

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

IMSYSTEM  
Via Palermo, 6  
09023 Monastir (CA)  
Tel: 070-9177558  
Fax: 178-2207119  
www.imsystem.com

HIROSS S.p.A.  
via Leonardo da Vincci, 8  
35028 Piove di Sacco (PD)  
Tel: 049-9719212  
Fax: 049-9719317  
www.hiross.com

WORTHINGTON S.p.A.  
Flowserve Corporation  
Via Rossini, 90/92  
20033 Desio - Milano  
Tel: 0362-6121  
Fax: 0362-303396  
www.flowserve.com

#### 2.1.7 Compressed Air Steel Piping

The following manufacturers provide steel piping for low pressure compressed air systems that generally comply with these specifications:

DALMINE  
Piazza Caduti 6 Luglio 1944, 1  
24044 Dalmine (BG)

Tel: 035560-1111  
Fax: 035560-3827  
www.dalmine.it

OPPO Gesuino  
Via Amerigo Vespucci, 1  
09074 Ghilarza (OR)  
Tel: 0785-54642  
www.oppo.it

STEEL TRADE  
Loc. Cattagnina  
29100 Rottofreno (PC)  
Tel: 0523-780121  
Fax: 0523-780123  
www.steeltradeitaly.com

JANNONE ARM S.p.A.  
Via Nuova Villa, 29  
80100 Napoli  
Tel: 081-7523788  
Fax: 081-7523425  
www.jannonearm.com

JANNONE TUBI s.r.l.  
via Biagio Accolti Gil - zona industriale  
Bari  
Tel: 080-5311448  
Fax: 080-5312976  
www.jannonearm.com

#### 2.1.8 Compressed Air Copper Tubing

The following manufacturers provide copper tubing for low pressure compressed air systems that generally comply with these specifications:

IDROSTAR S.n.c.  
Via Pascoli, 17  
28040 Dormelletto (NO)  
Tel: 0322-497245  
Fax: 0322-498184

OPPO Gesuino  
Via Amerigo Vespucci, 1  
09074 Ghilarza (OR)  
Tel: 0785-54642  
www.oppo.it

FRA.BO S.p.A.  
Voa Corcpmva; azopme, 7  
26020 Bordolano (CR)  
Tel: 0372-925188  
Fax: 0372-95886  
www.frabo.net

SANCO  
EUROPA MATALLI S.p.A.  
Via Corradino D'Ascanio, 4  
20142 Milano  
Tel: 02-893-881  
Fax: 02-893-88473  
www.europametalli.it

ZETAESSE S.p.A.  
Via Vicenza, 45  
31050 Vedelago - Treviso  
Tel: 0423-400621  
Fax: 0423-401177  
www.zetaesse.it

#### 2.1.9 Gate Valves

The following manufacturers provide gate type valves for low pressure compressed air systems that generally comply with these specifications:

MARIANI RUBINETTERIE INDUSTRIALI srl  
Via per Valduggia, 12  
13011 Borgosesia (VC)  
Tel: 0163-23368  
Fax: 0163-27900  
www.marianirubinetterie.it

RASTELLI RUBINETTERIE S.p.A.  
Regione Monticelli 10/14  
28045 Invorio (NO)  
Tel: 0322-255431  
Fax: 0322-255117  
www.rastelli.it

EURA srl  
Via Bissolati, 6  
20125 Milano  
Tel: 02-60781714  
Fax: 02-6887635  
e-mail: eura.valves@tiscalinet.it

KSB ITALIA S.p.A.  
Viale Tunisia, 46  
20214 Milano  
Tel: 02-6274-3273  
Fax: 02-6698-3272

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

#### 2.1.10 Globe and Angle Valves

The following manufacturers provide globe and angle type valves for low pressure compressed air systems that generally comply with these specifications:

MARIANI RUBINETTERIE INDUSTRIALI srl  
Via per Valduggia, 12  
13011 Borgosesia (VC)  
Tel: 0163-23368  
Fax: 0163-27900  
www.marianirubinetterie.it

EURA srl  
Via Bissolati, 6  
20125 Milano  
Tel: 02-60781714  
Fax: 02-6887635  
e-mail: eura.valves@tiscalinet.it

KSB ITALIA S.p.A.  
Viale Tunisia, 46  
20214 Milano  
Tel: 02-6274-3273  
Fax: 02-6698-3272

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

#### 2.1.11 Pressure Reducing Valves

The following manufacturers provide pressure reduction type valves for low pressure compressed air systems that generally comply with these specifications:

MCR srl  
Via E. Brigatti, 52/C  
22050 Ronco Briantino (MI)  
Tel: 039-6815152  
Fax: 039-6815148

HYDRAFORCE HYDRAULICS, Ltd.  
Via Enrico da Porto, 10C  
37023 Grezzana (Verona)  
Tel: 045-8650696  
Fax: 045-8669602

FAR RUBINETTERIE S.p.A.  
Via Morena, 20  
28024 Gozzano (NO)  
Tel: 0322-94722

Fax: 0322-955332  
www.far-spa.it

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

#### 2.1.12 Safety Valves

The following manufacturers provide safety type valves for low pressure compressed air systems that generally comply with these specifications:

A.S.T.  
Via R. Merendi, 20  
20010 Cornaredo (MI)  
Tel: 0293-560606  
Fax: 0923-62248  
www.astspa.it

TYCO Valves & Controls  
Distribution Italy  
Lugagnano Val d'Arda  
Piacenza, 29018  
Tel: 0523-890201  
Fax: 0523-890290

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

#### 2.1.13 Check Valves

The following manufacturers provide check valves for low pressure compressed air systems that generally comply with these specifications:

MARIANI RUBINETTERIE INDUSTRIALI srl  
Via per Valduggia, 12  
13011 Borgosesia (VC)  
Tel: 0163-23368  
Fax: 0163-27900  
www.marianirubinetterie.it

VILLA VALVOLE  
via Scappini, 11  
16149 Genova  
Tel: 01064-44949  
Fax: 01064-50996

CAZZANIGA S.p.A.  
Via Parco

20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

KSB ITALIA S.p.A.  
Viale Tunisia, 46  
20214 Milano  
Tel: 02-6274-3273  
Fax: 02-6698-3272

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

#### 2.1.14 Pressure Regulators

The following manufacturers provide pressure regulators for low pressure compressed air systems that generally comply with these specifications:

FLUIDO SYSTEM srl  
Via Nicodeme Bianchi, 61/3  
10146 Torino  
Tel: 011-797322  
Fax: 011-797412

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
[www.swagelok.com](http://www.swagelok.com)

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

#### 2.1.15 Needle Valves

The following manufacturers provide needle valves for low pressure compressed air systems that generally comply with these specifications:

MARIANI RUBINETTERIE INDUSTRIALI srl  
Via per Valduggia, 12  
13011 Borgosesia (VC)

Tel: 0163-23368  
Fax: 0163-27900  
www.marianirubinetterie.it

SBC srl  
Via Tolstói, 86  
20098 San Giuliano (MI)  
Tel: 02-98491676  
Fax: 02-98491712  
www.sbc-it.com

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

#### 2.1.16 Pressure Gages

The following manufacturers provide pressure gages for low pressure compressed air systems that generally comply with these specifications:

WIKA Italiana S.r.l.  
Via Achille Grandi, 4  
20017 Mazzo di Rho (MI)  
Tel: 02-9397001  
www.wika.it

NUOVA FIMA  
Via Cesare Battisti, 59  
28045 Inverio (NO)  
Tel: 0322-253200  
Fax: 0322-253232

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

CAZZANIGA S.p.A.  
Via Parco  
20046 Biassono - Milano  
Tel: 039-49861  
Fax: 039-4986222

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

#### 2.1.17 Hangers and Supports

The following manufacturers provide hangers and support materials for low pressure compressed air systems that generally comply with these specifications:

PROSYSTEM  
Via dell'Industria, 2  
30031 Arino di Dolo (VE)  
Tel: 041/5101622  
Fax: 041/5131351  
E-mail: info@prosystemitalia.com  
www.prosystemitalia.com

GRINNEL SALES & DISTRIBUTION  
Via San Giacomo, 260  
39055 Laives (BZ)  
Tel: 0471/252091  
Fax: 0471/254058

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

#### 2.1.18 Quick Disconnect Couplings

The following manufacturers provide quick disconnect couplings for low pressure compressed air systems that generally comply with these specifications:

ERRE.DI srl  
Via dei Laboratori, 15  
20092 Cinisello Balsamo (MI)  
Tel: 2660-40229  
Fax: 2612-8041

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)

Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

JUCKER S.p.A.  
via G. Verdi, 9  
23871 Lomagna (LC)  
Tel: 039-59181  
Fax: 039-5301286  
www.jucker.it

#### 2.1.19 Filters

The following manufacturers provide single cartridge type filters for low pressure compressed air systems that generally comply with these specifications:

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

ATLAS COPCO ITALIA S.p.A.  
Via Fratelli Gracchi, 39  
20092 Cinisello Balsamo (MI)  
Tel: 02-617991  
Fax: 026171949  
www.atlascopco.it

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

JUCKER S.p.A.  
via G. Verdi, 9  
23871 Lomagna (LC)  
Tel: 039-59181  
Fax: 039-5301286  
www.jucker.it

#### 2.1.20 Strainers

The following manufacturers provide strainers for low pressure compressed air systems that generally comply with these specifications:

MARIANI RUBINETTERIE INDUSTRIALI srl  
Via per Valduggia, 12  
13011 Borgosesia (VC)  
Tel: 0163-23368  
Fax: 0163-27900  
www.marianirubinetterie.it

EURA srl  
Via Bissolati, 6  
20125 Milano  
Tel: 02-60781714  
Fax: 02-6887635  
e-mail: eura.valves@tiscalinet.it

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

JUCKER S.p.A.  
via G. Verdi, 9  
23871 Lomagna (LC)  
Tel: 039-59181  
Fax: 039-5301286  
www.jucker.it

#### 2.1.21 Traps

The following manufacturers provide traps for low pressure compressed air systems that generally comply with these specifications:

AIRTEC  
Via Torquato Tasso, 13  
24020 Gorle (BG)  
Tel: 035-655988  
Fax: 035-669112  
www.airtecariacompressa.com

VALSAR srl  
Via Benadir, 14  
20132 Milano  
Tel: 02-2613744  
Fax: 02-2829633  
www.valsar.it

FINI COMPRESSORS S.p.A.  
Via F.lli Vignoli, 3  
40069 Zola Predona - Bologna  
Tel: 051-6168111  
Fax: 051-752408

JUCKER S.p.A.

via G. Verdi, 9  
23871 Lomagna (LC)  
Tel: 039-59181  
Fax: 039-5301286  
www.jucker.it

#### 2.1.22 Lubricators

The following manufacturers provide lubricators for low pressure compressed air systems that generally comply with these specifications:

FLUIDO SYSTEM srl  
Via Nicodeme Bianchi, 61/3  
10146 Torino  
Tel: 011-797322  
Fax: 011-797412

AZ PNEUMATICAL Srl  
Via J.F. Kennedy, 26  
I-20020 Misinto (MI)  
Tel: 02-9632-8519  
Fax: 02-9672-0095

#### 2.1.23 Dielectric Unions

The following manufacturers provide dielectric unions for low pressure compressed air systems that generally comply with these specifications:

OPPO Gesuino  
Via Amerigo Vespucci, 1  
09074 Ghilarza (OR)  
Tel: 0785-54642  
www.oppo.it

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

#### 2.1.24 Valve Boxes

The following manufacturers provide valve boxes for low pressure compressed air systems that generally comply with these specifications:

MUSILLI PREFABBRICATI  
Via Casilina Sud, 49  
Tel: 0776-312440  
Fax: 0776-310420  
www.musilli.it

MARIO CIRINO POMICINO S.p.A.  
Strada Provinciale Arzano

80022 Arzano (NA)  
Tel: 081-5734740  
Fax: 081-5731418  
www.mcpomicino.it

#### 2.1.25 Identification Labels for Piping

The following manufacturers provide various types of identification labels for low pressure compressed air systems that generally comply with these specifications:

PROSYSTEM  
Via dell'Industria, 2  
30031 Arino di Dolo (VE)  
Tel: 041-5101622  
Fax: 041-5131351  
e-mail: info@prosystemitalia.com  
www.prosystemitalia.com

GENERAL FIRE  
Via Casilina, 159  
00176 Roma  
Tel: 06-70301043-9  
Fax: 06-70301043  
www.generalfire.it

#### 2.1.26 Identification Tape

The following manufacturers provide identification tape for buried utility piping that generally comply with these specifications:

COMBY ITALIA srl  
Via Roma, 28  
Padenghe sul Garda  
25080 Brescia  
Tel: 030-9907203  
Fax: 030-9900428

SWAGELOK-NORDIVAL Srl  
Via Iseo, 6/A  
25030 Erbusco (BS)  
Tel: 030-7722055  
Fax: 030-7722024  
www.swagelok.com

OPPO Gesuino  
Via Amerigo Vespucci, 1  
09074 Ghilarza (OR)  
Tel: 0785-54642  
www.oppo.it

#### 2.2 LOW PRESSURE AIR COMPRESSOR, 7.5 TO 224 KW

\*\*\*\*\*

**NOTE: Prepare section for cooling water and include in project specification. See Section 15181 for piping and equipment which may be useful.**

\*\*\*\*\*

7.5 kW to 224 kW, up to 862 kPa (gage). Configuration and dimensions of the air compressor shall be compatible with the indicated space allocated. Sound level shall not exceed 84 dBA one meter from compressor unit. Conform to ISO 5390, ISO 8010, ISO 8012, and following ordering data (paragraph 6.2) thereof:

- a. Specification title, number and date: As listed hereinbefore under "REFERENCES."
- b. Type: [Single acting (reciprocating)] [Double acting (reciprocating)] [Rotary (vane, screw)].
- c. Issue date of applicable specifications and standards: As specified.
- d. Packaged assembly requirement: [Packaged Unit required] [Field assembled].
- e. First article inspection: [Not required; furnish certified test report.] [Required.]
- f. Capacity (cms): [At least as indicated.] [cms:\_\_\_\_\_].  
Discharge working pressure: [At least as indicated.] [kPa (gage): \_\_\_\_\_].
- g. Number of stages for single acting (reciprocating) compressor: [Single stage] [Two stages].  
Water-jacketed cooling: [Not applicable.] [Required] [Not required].
- h. Number of stages for double acting (reciprocating) compressor: [Single Stage] [Two stages] [Not applicable].
- i. Oil-free air delivery double acting (reciprocating) compressors: [Required.] [Not required.]
- j. Type bearings: Manufacturer's standard.
- k. Air filter to function as muffler: Required.
- l. Air Filter conformance with MS: Not required; provide manufacturer's standard.
- m. Safety valve in discharge line when no receiver provided: [Not applicable.] [Required.]
- n. Shut-off valve on compressor discharge: [Not required] [Required].

- o. Oil Filter: Provide manufacturer's standard.
- p. Drain plug conformance with MS: Not required; provide manufacturer's standard.
- q. Electric, thermostatically controlled immersion oil heater: [Not] required.
- r. Compressor regulation method: [Constant-speed control]. [Dual control: Alternative constant speed or automatic start-stop.]
- s. Timed stop control (for constant speed control: [Not applicable] [Required]).

\*\*\*\*\*  
**NOTE: Edit Table A to select only the optional safety controls required for the project.**  
 \*\*\*\*\*

- t. Optional safety controls required: As specified on Table A.

TABLE A. OPTIONAL SAFETY CONTROLS

	Single Acting		Double Acting		Rotary	
	Alarm	Shut Down	Alarm	Shut Down	Alarm	Shut Down
High-lubrication oil temp.	-	-	x	x	x	x
Cylinder lubrication failure	-	-	-	x	-	-
High main bearing temperature	-	x	-	x	-	x
High discharge-air temperature	x	x	x	x	x	x
High discharge-air pressure	x	x	x	x	x	x
High intercooler air temp.	x	x	x	x	-	-
Low cooling water flow	-	x	-	x	-	-
Low water pressure	-	x	-	x	-	-
High water temperature	x	x	x	x	-	-
High intercooler moisture separator level (two-stage compressors only)	x	x	x	x	-	-
Excessively high motor temp.	x	-	x	-	x	-
Excessive vibration	-	x	-	x	-	-

- u. Gages and visual I.D. lights mounting (optional controls): [Panel-mounted.] [Mounted on separate console.] [Not applicable.]
- v. Aftercooler: Required; [Water-cooled, shell-and-tube type] [or] [air-cooled, tube-and-fin type]. A centrifugal moisture separator is also required.
- w. Air receiver: [Required] [Not required].

- x. Receiver volume: [As indicated.] [[\_\_\_\_\_] liter] [[\_\_\_\_\_] cu. meter] [Not applicable].
- y. Receiver mounting stand: [Required] [Not required] [Not applicable].  
  
Position of receiver: [Horizontal] [Vertical].
- z. Compressor and motor: [Required] [Not required]. To be mounted on receiver: [Not applicable].
- aa. Compressor housing (III units): [Not applicable] [Required].
- bb. Motor: As indicated.
- cc. Electrical power supply characteristics: As indicated.
- dd. Motors 93 kW and larger to be synchronous: [Required] [Not required] [Not applicable].
- ee. Motor starter: As indicated.
- ff. Provision for limitation of starting current inrush: [Required] [Not required] [Not applicable].
- gg. Type Drive: [Direct drive] [Multi-V-Belt drive].  
  
Direct drive coupling: [Close-coupled] [Integral-coupled] [Flexible-coupled] [Not applicable].
- hh. Electromagnetic interference control: [Not required] [Required].
- ii. Fungus resistance: Not required.
- jj. Cleaning, treatment, and painting: [As indicated] [Other: (specify)].
- kk. Cleaning, treatment and painting in accordance with Section 09900, "Paints and Coatings."
- ll. Color of finish coat: [Manufacturer's standard] [Other: [\_\_\_\_\_]-(specify)-Samples required.]
- mm. Initial lubrication: Factory lubrication service required.
- nn. Skid base (Type II or III): Required.
- oo. Lifting attachments and tiedown device: Lifting attachments as required. Tiedown devices [required.] [Not required.]
- pp. Spare parts and maintenance tools: Not required.
- qq. Tool boxes: Not required.

rr. Production pack inspection: Not required.

ss. Level of preservation packaging, and packing: Level C or better  
(Delivery of unit to project site in undamaged condition is Contractor's responsibility.)

tt. Preservation-packaging: Not applicable.

## 2.3 LOW PRESSURE AIR COMPRESSOR UNIT, LESS THAN 7.5 kW

Low pressure air compressor unit, less than 7.5 kW, up to 862 kPa (gage), shall conform to ISO 5390, ISO 8010, ISO 8012, and the following:

### 2.3.1 Compressor and Receiver Capacity

Sized as indicated. [Oil-free air] [Air] delivered at indicated pressure.

### 2.3.2 Mounting

Common sub-base for receiver and compressor.

### 2.3.3 Compressor Type

Reciprocating [or rotary].

### 2.3.4 Nameplate

Metal, securely fastened to equipment or base, listing:

Manufacturer's name and address  
Model and serial numbers  
Compressor operating data and rating.

### 2.3.5 Receiver

Provide service valve, pressure gage, and safety valve in accordance with D.L. 93 and UNI 9335.

### 2.3.6 Receiver Condensate Drain

Automatic float-type trap per UNI EN 26704.

### 2.3.7 Compressor Accessories

Air inlet filter and silencer. Air-cooled intercooler and aftercooler which reduce air discharge temperature to 38 degrees C.

### 2.3.8 Control

Unloaded start with enclosed diaphragm-type pressure switch automatically controlling start-and-stop.

### 2.3.9 Motor

Squirrel-cage induction motor with drip-proof enclosure and conforming with CEI EN 60034-1, suitable for operation on the indicated power supply. Rated horsepower of motor shall equal or exceed power required for continuous operation of compressor at full load.

2.3.10 Starter

Capacity and electrical characteristics shall be compatible with motor. Starter shall conform with CEI EN 60947-4-1 with CEI EN 50298 enclosure. Include thermal overload protection of all phases.

2.3.11 Noise

84 dBA maximum sound level one meter from compressor unit.

2.4 LOW PRESSURE AIR RECEIVER

D.L. 93, labeled and rated for [862] [1379] kPa (gage), equipped with required valves and trimmings, including gage and automatic drain valve and pressure safety relief valve. Pressure as indicated. [Sandblast exterior and interior to near-white. Lining shall be a factory applied 0.20 mm minimum white epoxy coating.] Exterior finish shall be [standard factory finish] [two coats of rust inhibitor primer and one coat epoxy enamel].

2.5 LOW PRESSURE COMPRESSED AIR DRYERS

\*\*\*\*\*  
**NOTE: Normally used for under 944 scms capacity systems.**  
\*\*\*\*\*

Provide low pressure compressed air dryers of the mechanical refrigeration type, equipped with an automatic temperature shutdown switch to prevent freezing, a regenerative air to air exchanger (in capacity sizes above 4.72 or 28.31 scms as standard with the manufacturer), and a main compressed air cooling exchanger. Refrigeration system shall cool compressed air to dry the air. Dryer shall have no internal traps or filters and shall have pressure drop not greater than [20.68] [\_\_\_\_\_] kPa [indicated]. Air shall leave the dryer at a temperature of [\_\_\_\_\_] degrees C and dew point of [\_\_\_\_\_] degrees C, based on an inlet temperature of [38] [\_\_\_\_\_] degrees C. Provide internal tubing, wiring, and piping complete, such that only connections to air inlet and outlet, to refrigerant compressor contactor, and to condensate drain are necessary.

2.5.1 Air Circuit

- a. Regenerative Heat Exchanger: Inlet compressed air to outlet compressed air heat exchanger (in capacity sizes above 4.70 or 28.30 scms as standard with the manufacturer) designed to reduce cooling load at design conditions minus 7 degrees C by inlet air precooling.
- b. Main Heat Exchanger: Single-pass, with air in the tubes, heat sink, direct expansion, or flooded cooler type.

- c. Separator: Fabricated in accordance with ASME B31.1; code stamp not required; moisture separator low velocity type incorporating change of air flow direction to prevent moisture carryover.
- d. Dryer Operating Pressure: 862 kPa (gage) working pressure.
- e. Drain Line: Provide with exterior mounted condensate trap to facilitate servicing.

2.5.2 Refrigeration System

- a. Refrigeration Compressor: ARI 520. Hermetic, semi-hermetic, or open reciprocating type equipped with automatic start-stop or unloading capacity control; standard components include inherent motor protection, crankcase oil strainer, and suction screen. Refrigerant shall be R407-C or R134a.
- b. Dryer Controls: Capable of automatic 0 to 100 percent capacity control. Refrigeration controls shall maintain pressure dew point within the specified range without freezing of condensate. Controls shall include such devices as capillary tube, expansion valve, suction pressure regulator, thermostat, or other approved devices as standard with the manufacturer. Dryer shall have automatic shutdown switch sensor located at point of lowest temperature to prevent freezing.
- c. Refrigerant dryer and suction line strainer.
- d. Air-cooled condenser, with condenser fan and motor.

2.5.3 Instrumentation and Control

Include control panel in dryer cabinet containing:

- a. Indicators for the Following Services: Inlet air pressure gage, discharge air pressure gage, inlet air temperature gage, main exchanger temperature gage, refrigeration compressor suction pressure gage, refrigeration compressor discharge pressure gage, green "Power On" light, power interruption light, and high temperature light.
- b. Electrical Relays: Locate in an enclosed portion of the panel, accessible for ease of servicing.
- c. Controls and Interlocks: To maintain required compressed air dew point and to cycle air-cooled condenser with refrigeration compressor [while maintaining head pressure control with low ambient temperature].

2.6 LOW PRESSURE COMPRESSED AIR DRYER (CHILLED WATER TYPE)

\*\*\*\*\*

**NOTE: Chilled water air dryers are usually provided**

for 944 scms and larger capacities. CAUTION:  
Specify correct system pressure. If the  
specification is edited to use a dryer with direct  
heat exchange between air and refrigerant, assure  
that the air is not used for breathing since  
refrigerant leakage into the compressed air may be  
hazardous to personnel; warning signs may be  
required.

\*\*\*\*\*

Provide low pressure compressed air dryer of the mechanical refrigerator type, with closed chilled water system, regenerative air to air exchanger, and main compressed air to water heat exchanger. Refrigeration system shall produce chilled water which, in turn, circulates through air-water exchanger to dry the air. Provide internal tubing, wiring and piping complete, such that only connections to air inlet and outlet, to pump contactor, to refrigerant compressor contactor, to condensate drain, and to air cooled condenser need be provided. Dryer shall be suitable for a compressed air operating pressure of 862 kPa (gage), with air leaving temperature of [\_\_\_\_\_] degrees C and dew point of [\_\_\_\_\_] degrees C at rated pressure.

#### 2.6.1 Air Circuit

- a. Regenerative Heat Exchanger: Air to air exchanger, with inlet air passing through tubes and outlet air in shell, designed to reduce cooling load at design conditions by precooling inlet air minus 7 degrees C.
- b. Main Heat Exchanger: D.L. 93. Shell and tube construction, single-pass, with air in tubes and water in shell, designed for minimum air pressure drop, flanged connections, tubes rolled into tube sheets.
- c. Separator: D.L. 93. Fabricated of carbon steel.
- d. Drain: With condensate trap.

#### 2.6.2 Chilled Water Circuit

- a. Circulating Pump: Single stage, mechanical seals, electric motor driven with line shut-off valves.
- b. Liquid Cooler: D.L. 93. Direct expansion, refrigerant in tubes, water in shell, designed for 2068 kPa (gage) working pressure, removable tube bundle, and insulated with foam type insulation.
- c. Expansion Tank: With sight glass, vent, and fill cock.
- d. Flow Switch: To shut down refrigeration compressor on loss of chilled water flow.

#### 2.6.3 Refrigeration System

- a. Refrigeration Compressor: ARI 520. Hermetic or semihermetic reciprocating type, with 183 rad/sec motor, integral capacity control, oil pressure pump, oil scavenger pump, full-flow oil filter, oil sight glass, inherent motor protection, crankcase heater, suction and discharge service valve, crankcase oil strainer, Monel suction screen, and hot gas bypass capacity control below last step of unloading. Refrigerant shall be R407-C or R134a.
- b. Accessories: Include a discharge line muffler, sight glass, refrigerant dryer, solenoid valve, thermostatic expansion valve, and suction line strainer.
- c. Air-cooled Condenser: As indicated. Complete air-cooled condenser factory-fabricated and assembled unit consisting of coils, fans, and electric-motor drive. Base capacity at design conditions on minus 7 degrees C temperature differential between entering air and condensing refrigerant. Saturated refrigerant condensing temperature not over 40.5 degrees C. Base entering dry bulb outside air temperature on [32] [\_\_\_\_\_] degrees C. Do not take subcooling into account in determining compressor and condenser capacities. Air-cooled condenser may be used for refrigerant storage in lieu of a separate receiver, provided that condenser storage capacity is 20 percent in excess of fully charged system. [Provide head pressure control during low ambient temperature.]

#### 2.6.4 Instrumentation and Control

Provide a control panel on the dryer containing:

- a. Pressure gages (114 mm diameter) for the following services:
  - (1) Inlet air
  - (2) Condenser water inlet
  - (3) Refrigeration compressor suction
  - (4) Refrigeration compressor oil pressure
  - (5) Outlet air
  - (6) Condenser water outlet
  - (7) Refrigeration compressor discharge
- b. Electrical Relays: Locate in an enclosed portion of the panel, accessible from front of panel.
- c. Start-Stop buttons and green running indicating light.
- d. Controls and Interlocks

- (1) 220-volt control transformer
- (2) Circulating pump across the line contactor
- (3) Compressor across the line contactor
- (4) Condenser water pressure safety switch
- (5) Freeze protection safety switch
- (6) Pump-out relay with normally open and normally closed contacts
- (7) Oil safety switch
- (8) Four stage thermostatic control
- (9) Refrigerant dual pressure switch

#### 2.6.5 Temperature Indicators

- a. Air inlet
- b. Air outlet
- c. Chilled water in
- d. Chilled water out
- e. Dew point

#### 2.7 DESICCANT AIR DRYERS

D.L. 93. Chamber of welded steel, 862 kPa (gage) working pressure, with flanged or threaded fittings, and [manual] [automatic] drain valve. Manufacturer's recommended desiccant in tablet form which will not nest or cake. Contractor shall provide a supply of desiccant for initial operations in unbroken shipping containers equal to not less than four charges of desiccant for the dryer.

#### 2.8 LOW PRESSURE COMPRESSED AIR PIPING AND ACCESSORIES

Low pressure compressed air piping and accessories 862 kPa (gage) at 65.5 degrees C, shall conform to the following:

##### 2.8.1 Steel Piping

- a. Pipe: UNI 8863/FA-1, UNI EN 10216-1, and ASTM A 53, seamless [or electric resistance welded] carbon steel, Schedule 40, black.
- b. Fittings, size 50 mm and larger: ASME/ANSI B16.9 and UNI EN 10253-1, carbon steel, butt welding, schedule 40, or ASME/ANSI B16.5, carbon steel welding neck flanges, Class 150, UNI 2278 or ASME/ANSI B16.5, flanged fittings, carbon steel, Class 150, gaskets 1.50 mm oil resistant synthetic rubber UNI 2059, bolts and nuts,

UNI EN 1515-1 and UNI 6609. Butt welded joints shall be full penetration consumable insert or backing ring type.

- c. Fittings, size 40 mm and smaller: UNI EN 10242/A1, threaded malleable iron, or ASME B16.11, forged carbon steel Class 3000 socket welding or Class 2000 threaded. Joints may also be butt welded or flanged, as specified for sizes 50 mm and larger.
- d. Flat-faced steel flanges: Where connections are made to Class 125 cast iron flanges with steel flanges, use only flat-faced Class 150 steel flanges.
- e. Unions: UNI EN 10242/A1 (2068 kPa (gage) WOG).

#### 2.8.2 Copper Tubing

- a. Tubing: UNI EN 1057 and UNI EN 12449, hard drawn.
- b. Fittings: UNI EN 1254-1, UNI EN 1254-2, UNI EN 1254-3, and UNI EN 1254-5 wrought copper or bronze, with silver brazed joints.
- c. Brazing filler metal: UNI EN 1044.
- d. Unions: Bronze, UNI EN 1254-1, brazed joint type.
- e. Flanges and flanged fittings: ASME/ANSI B16.24 and UNI 2223 bronze, Class 150, gaskets, oil resistant synthetic rubber, UNI 2059, bolts and nuts UNI EN 1515-1 and UNI 6609.
- f. Flared fittings: UNI EN 1057 and UNI EN 1254-1 and UNI EN 1254-5.

#### 2.8.3 Valves

##### 2.8.3.1 Gate Valves

- a. Bronze Gate Valves: Class 150, 50 mm and smaller, wedge disc, rising stem, inside screw type, with brazed joints ends when used with copper tubing.
- b. Steel Gate Valves: 50 mm and smaller, UNI 6884 or ASME/ANSI B16.34, over 50 mm, flanged ends, outside screw and yoke type with solid wedge or flexible wedge disc, [Class 150] [as recommended by the manufacturer for the conditions indicated.] [Provide motor operator where indicated.]

##### 2.8.3.2 Globe and Angle Valves

- a. Bronze globe and angle valves: Class 150, 50 mm and smaller, Class 200, except that Class 150 valves with brazed ends may be used for copper tubing. Valves shall have renewable seats and discs except brazed-end valves which shall have integral seats.
- b. Steel globe and angle valves: 50 mm and smaller, UNI 6884 or ASME/ANSI B16.34, over 50 mm, flanged ends, [Class 150.] [As

recommended by the manufacturer for the conditions indicated.]  
[Provide motor operator where indicated.]

#### 2.8.3.3 Pressure Reducing Valves

UNI EN 1567, with nominal pressure rating of not less than inlet system pressure indicated. Provide pressure reducing valves capable of being adjusted to specified flow and pressure, and suitable for intended service. Provide pilot valve for dome loaded type if required for proper operation.

#### 2.8.3.4 Safety Valves

UNI 9335, 862 kPa (gage), for unfired pressure vessels, bronze, with threaded or flanged connections; factory set and sealed.

#### 2.8.3.5 Check Valves

UNI 6884 and UNI EN 1074-3. Bronze body with brazed joint or threaded ends or steel body with flanged end, ASME/ANSI B16.34, or threaded ends,. The check valve shall have a perforated piston with closed downstream end, in line with the pipe and held closed by a steel poppet return spring.

#### 2.8.3.6 Pressure Regulators

Diaphragm type, air loaded, tight closing single seat, brass body [with integral filter and bowl]. [Pressure regulators used to deliver compressed air for cleaning shall be factory set at not more than 207 kPa (gage) and shall be nonadjustable.]

#### 2.8.3.7 Needle Valves

One-piece bodies with integral or screwed bonnet, stems of hardened stainless steel with fine thread for metering and ease of adjusting, teflon packing; and shall be of the pressure balanced type. Needle valves shall be of the slow opening type.

#### 2.8.3.8 Ball Valves

Full port design, copper alloy body, except sizes 65 mm and larger shall be ANSI Class 150 steel-bodied. Valves shall have 2-position lever handles.

#### 2.8.4 Pressure Gages

UNI 4668, UNI EN 837-1, UNI EN 837-2, and UNI EN 837-3, or ASME/ANSI B40.100, Accuracy Grade A, for air, with steel or brass case, and nonshatterable safety glass, and a pressure blowout back to prevent glass from flying out in case of an explosion. Gages shall have a 90 mm minimum diameter dial and a dial range of approximately twice working pressure.

#### 2.8.5 Hangers and Supports

Provide pipe hangers and supports conforming to UNI 5311 and UNI 7145, except as specified or indicated otherwise. Furnish zinc plated pipe hangers and supports except for copper plated inserts for copper piping.

Provide tubing supports of U-shaped steel bolts and nuts firmly secured to adequately support structures such as walls, columns, floors, or brackets. Clips shall fit closely around piping but shall have sufficient clearance to permit longitudinal movement of piping during normal expansion and contraction. Provide supports at valves, fittings, branch lines, outlets, changes in direction, equipment, and accessories.

#### 2.8.6 Quick Disconnect Couplings

All brass and suitable for a working pressure of not less than 862 kPa (gage). Female side of coupling (fixed end) shall have male thread connection with automatic shutoff. Provide male side of coupling with hose stem and ball check to bleed pressure from hose and prevent hose whipping.

#### 2.8.7 Single Cartridge Type Filters

862 kPa (gage) operating pressure and filter housing of brass or bronze. Provide cellulose cartridge filters of graded density construction capable of removing liquids and solids of 5 microns and larger. Filter capacity shall be compatible with rated flow of equipment or pressure reducing valves provided.

#### 2.8.8 Strainers

Bronze or malleable iron body, Class 125, Style Y, simplex type, with 20-mesh Monel or stainless steel screen.

#### 2.8.9 Traps

UNI EN 26704 to drain water and other liquids from system. Type of traps, as indicated, and rated working pressure not less than system operating pressure.

#### 2.8.10 Lubricators

Brass body, 862 kPa (gage) minimum rating, with [clear plastic bowl and metal guard.] [metal bowl.]

#### 2.8.11 Flexible Connections

Vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze end connections, suitable for pressure indicated. Length as recommended by manufacturer but not less than [457] [\_\_\_\_\_] mm.

#### 2.8.12 Dielectric Unions

Steel female pipe thread end and copper solder-joint ends, conforming to dimensional, strength and pressure requirements of UNI 10284 and UNI 10285. Steel parts shall be galvanized or plated. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, it shall also be able to withstand a 600-volt breakdown test.

### 2.8.13 Tetrafluoroethylene Tape

For screw-jointed pipe.

### 2.8.14 Hose Reel Assembly

Complete with 15 meters hose rated for a minimum of 862 kPa (gage), ball stop, hose extension with air coupler, hose rollers, [reel enclosure,] [nonsparking ratchet pawl,] and required accessories.

## 2.9 SLEEVES

### 2.9.1 Floor Slabs, Roof Slabs, and Outside Walls Above and Below Grade

Galvanized-steel pipe having an inside diameter at least 12.70 mm larger than the outside diameter of the pipe passing through it. Provide sufficient sleeve length to extend completely through floors, roofs, and walls, so that sleeve ends are flush with finished surfaces except that ends of sleeves for floor slabs shall extend 15 mm above finished floor surface. Sleeves located in waterproofed construction shall include flange and clamping ring.

### 2.9.2 Partitions

Galvanized sheet steel, 0.55 mm or heavier, of sufficient length to completely extend through partition thickness with sleeve ends flush with partition finished surface.

## 2.10 VALVE BOX

Provide rectangular concrete design with words "Compressed Air" cast or otherwise marked on the cover. Size shall be large enough for removal of valve without removing box. Provide valve box for areas as follows:

- a. Roads & traffic areas: Heavy Duty, cast iron cover
- b. Other areas: Standard duty, heavy steel plate or concrete cover

## 2.11 IDENTIFICATION LABELS FOR PIPING

Labels for pipes 20 mm o.d. and larger shall bear printed legends to identify contents of pipes and arrows to show direction of flow. Except that of pipes smaller than 20 mm o.d., labels shall have color coded backgrounds to signify levels of hazard in accordance with UNI 5634. Legends and type and size or characters shall also conform to UNI 5634. Labels shall be made of plastic sheet with pressure-sensitive adhesive suitable for the intended applications or they may be premolded of plastic to fit over specific pipe outside diameters 20 mm and larger. For pipes smaller than 20 mm o.d., furnish brass identification tags 38 mm in diameter with legends in depressed black-filled characters.

## 2.12 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

Polyethylene plastic tape manufactured specifically for warning and

identification of buried utility lines. Tape shall be of the type provided in rolls, 150 mm minimum width, color codes for compressed air (gray) with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be "CAUTION BURIED COMPRESSED AIR LINE BELOW" or similar wording in both English and Italian. Code and letter coloring shall be permanent, unaffected by moisture and other substances contained in trench backfill material.

#### 2.13 FRESH WATER

Fresh water for cleaning, flushing, and testing shall be clean and potable.

#### 2.14 SOURCE QUALITY CONTROL

Test air compressors and compressed air dryers at the factory to assure proper operation. Certify satisfactory accomplishment of tests.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with the manufacturer's recommendations.

##### 3.1.1 Excavation and Backfilling

Section 02315, "Excavation and Fill."

##### 3.1.2 Corrosion Protection

Provide corrosion protection for buried steel piping in accordance with Section 09974, "Protection of Buried Steel Piping and Steel Bulkhead Tie Rods."

##### 3.1.3 Piping

Unless specifically stated to the contrary, fabrication, assembly, welding, and brazing shall conform to ASME B31.1 for all piping of the air system. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established for the work. Work piping into place without springing or forcing, except where cold-springing is specified. Piping and equipment within buildings shall be entirely out of the way of lighting fixtures and doors, windows, and other openings. Locate overhead piping in buildings in the most inconspicuous positions. Do not bury or conceal piping until it has been inspected, tested, and approved. Where pipe passes through building structure, pipe joints shall not be concealed, but shall be located where they may be readily inspected and building structure shall not be weakened. Avoid interference with other piping, conduit, or equipment. Except where specifically shown otherwise, vertical piping shall run plumb and straight and parallel to walls. Piping connected to equipment shall be installed to provide flexibility for vibration. Adequately support and anchor piping so that strain from weight of piping is not imposed on the equipment.

### 3.1.3.1 Fittings

\*\*\*\*\*  
**NOTE: Delete bending of medium and high pressure  
pipe when not included in project.**  
\*\*\*\*\*

Use long radius ells where appropriate to reduce pressure drops. Pipe bends in lieu of fittings may be used for low pressure piping where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and must be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with welding tees, except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used.

### 3.1.3.2 Clearances for Welding

Provide clearances from walls, ceilings, and floors to permit the installation of joints. The clearances shall be at least 150 mm for pipe sizes 100 mm and less, 250 mm for pipe sizes over 100 mm, and sufficient in corners. However, the specified clearances shall not waive requirements for welders to be qualified for the positions to be welded.

### 3.1.3.3 Cleaning and Flushing Procedures

Before jointing and erection of piping or tubing, thoroughly clean interiors of pipe sections, tube, and components. In steel pipe, loosen scale and other foreign matter by rapping sharply and expel by wire brush and swab. Blow out both steel pipe and copper tube and components with compressed air at 689 kPa (gage) or more. Maintain cleanliness by closure of pipe/tube openings with caps or plugs. Before making final terminal connections, blow out complete system with compressed air at 689 kPa (gage) or more.

### 3.1.3.4 Changes in Pipe Size

Use reducing fittings for changes in pipe size. The use of bushings will not be permitted. In horizontal lines, 65 mm and larger, reducing fittings shall be of the eccentric type to maintain the bottom of the lines in the same plane.

### 3.1.3.5 Drainage and Flexibility

Compressed air piping shall be free of unnecessary pockets and pitched approximately 25 mm per 10 meters in the direction of flow to low points. Where pipes must be sloped so that condensate flows in opposite direction to air flow, slope 50 mm per 10 meters or greater. Provide flexibility by use of fittings, loops, and offsets in piping. Install branches at top of a main to prevent carryover of condensate and foreign matter.

### 3.1.4 Threaded Joints

Where possible use pipe with factory cut threads, otherwise cut pipe ends square, remove fins and burrs, and cut taper pipe threads in accordance with UNI 4648 and UNI ISO 7-1. Threads shall be smooth, clean, and full cut. Apply thread tape to male threads only. Work piping into place without springing or forcing. Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed.

### 3.1.5 Welding and Brazing Procedures

Perform welding and brazing in accordance with qualified procedures using qualified welders and welding operators and brazers. Do not perform welding and brazing when the quality of the completed weld or braze could be impaired by the prevailing working or weather conditions. The Contracting Officer will determine when weather or working conditions are unsuitable for welding. Welding of hangers, supports, and plates to structural members shall be in accordance with UNI EN ISO 13920.

#### 3.1.5.1 Cleaning for Welding and Brazing

Surfaces to be welded or brazed shall be free from loose scale, slag, rust, paint, oil, and other foreign material. Joint surfaces shall be smooth and free from defects which might affect proper welding. Clean each layer of weld metal thoroughly by wire brushing, grinding, or chipping prior to inspection or deposition of additional weld metal.

#### 3.1.5.2 Stress Cracking During Brazing

For material susceptible to stress corrosion cracking from molten brazing filler metal, avoid applying stress during brazing.

#### 3.1.5.3 Welding or Brazing of Valves

Welding or Brazing of Valves: Disassemble valves subject to damage from heat during welding or brazing and reassemble after installation. Open valves two or three turns off the seat when not subject to heat damage during welding or brazing; do not backseat valve.

#### 3.1.6 Flare Fittings

Provide flare fittings only where necessary to connect copper tubing to equipment. Use short sections of annealed tubing soldered or brazed to hard drawn tubing using couplings on expanded ends on the annealed tubing made with special tools designed for that purpose. Make flares with the appropriate flaring tools. Cut annealed tubing only with cutting wheel tool. Do not ream out inside burr or lip left by the cutting wheel but fold back lip with flare tool to form seal/gasket inside flare. When new, the flare should cover not more than 75 percent of the flare seating surface of either the male or female flare fittings. Put the flare nut on the tube before making the flare.

#### 3.1.7 Valves

ASME B31.1. Install valves at the locations indicated and elsewhere as required for the proper functioning of the system.

3.1.7.1 Gate Valves

Provide gate valves unless otherwise directed. Install valves in positions accessible for operation and repair. Install valve with stem horizontal or above.

3.1.7.2 Globe Valves

Install globe valves so that the pressure will be below the disk. Install globe valves with the stems vertical.

3.1.7.3 Pressure-Reducing Valves

Provide compressed air entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two block valves and with a globe or angle bypass valve and bypass pipe. Provide a bypass around a reducing valve of reduced size to restrict its capacity to approximately that of the reducing valve. Provide each pressure reducing valve unit with an indicating gage to show the reduced pressure, and a safety valve on the low pressure side. These requirements do not apply to small pressure regulating valves used to adjust pressure for pneumatic equipment.

3.1.8 Hangers and Supports

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**NOTE: See NAVFAC P-355, "Seismic Design for Buildings," Chapter 10, "Mechanical and Electrical Elements," for calculating pipe support spacing for schedules not shown. Delete Table I and reference to seismic requirements if not required.**  
 \*\*\*\*\*

Selection, fabrication and installation of piping hangers and supports shall conform to UNI 5311, UNI 7145 [except that spacing of the hangers and supports shall be as per Table I.] [Provide seismic restraints for piping in accordance with PPIC GFSR.]

TABLE I. MAXIMUM SPAN FOR PIPE (METERS)

DIAMETER MM	STD. WT. STEEL PIPE SCHEDULE 40	EX. STRONG STEEL PIPE SCHEDULE 80	COPPER TUBE TYPE K	COPPER TUBE TYPE L
15	1.50	1.50	1.10	1.00
20	1.75	1.75	1.30	1.30
25	2.00	2.00	1.50	1.45

TABLE I. MAXIMUM SPAN FOR PIPE (METERS)

DIAMETER MM	STD. WT. STEEL PIPE SCHEDULE 40	EX. STRONG STEEL PIPE SCHEDULE 80	COPPER TUBE TYPE K	COPPER TUBE TYPE L
40	2.30	2.35	1.75	1.70
50	2.60	2.60	2.00	2.00
65	2.80	2.90	2.20	2.10
80	3.10	3.20	3.35	2.30
90	3.35	3.35	2.50	2.50
100	3.50	3.60	2.75	2.70
125	3.90	3.90	3.05	2.90
150	4.20	4.25	3.25	3.20
200	4.70	4.90		
250	5.20	5.30		
300	5.55	5.80		

3.1.9 Pressure Gages

Provide pressure gages with a shut-off valve or petcock installed between the gage and the line.

3.1.10 Strainers

Provide strainers with meshes suitable for the services where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

3.1.11 Equipment Foundations

Provide equipment foundations of sufficient size and weight and of proper design to preclude shifting of equipment under operating conditions or under any abnormal conditions which could be imposed upon the equipment. Provide foundations which meet the requirements of the equipment manufacturer, and when required by the Contracting Officer, obtain from the equipment manufacturer approval of the foundation design and construction for the equipment involved. Equipment vibration shall be maintained within acceptable limits, and shall be suitably dampened and isolated.

### 3.1.12 Equipment Installation

Install equipment strictly in accordance with these specifications, and the manufacturers' installation instructions. Grout equipment mounted on concrete foundations before piping is installed. Install piping in a manner that does not place a strain on any of the equipment. Do not bolt flanged joints tight unless they match properly. Extend expansion bends adequately before installation. Grade, anchor, guide and support piping without low pockets.

### 3.1.13 Cleaning of System

Clean the various system components before final closing as the installations are completed. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests will not be permitted until the cleaning is approved by the Contracting Officer.

### 3.1.14 Pipe Sleeves

Provide pipe sleeves where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Extend sleeves in floor slabs 50 mm above the finished floor. Pack space between the pipe or tubing and the sleeve firmly with oakum and caulk both ends of the sleeve with elastic cement.

### 3.1.15 Floor, Wall, and Ceiling Plates

Provide chromium-plated steel or nickel-plated cast iron plates on pipes passing through floors and partitions of finished rooms. Provide painted cast-iron, malleable iron, or steel for other areas.

### 3.1.16 Flashing for Buildings

Provide flashing [as required] [in accordance with Section 07600, "Flashing and Sheet Metal"] where pipes pass through building roofs and outside walls.

### 3.1.17 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each connection having a screwed-end valve. [Provide unions or flanges not farther apart than 30 meters.] [Provide unions or flanges as indicated.] Provide unions on piping under 50 mm in diameter, and provide flanges on piping 50 mm and over in diameter. Install dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections.

### 3.1.18 Painting of Piping and Equipment

Paint piping and equipment in accordance with Section 09900, "Paints and Coatings."

### 3.1.19 Identification of Piping

Identify piping in accordance with UNI 5634. Use commercially manufactured piping identification labels. Space identification marking on runs not farther apart than 15 meters. Provide two copies of the piping identification code framed under glass and install where directed.

### 3.1.20 Warning and Identification Tape

Coordinate installation of utility warning and identification tape with backfill operation. Provide tape above buried lines at a depth of 200 to 300 mm below finish grade.

## 3.2 CLEANING SILVERBRAZED PIPING

\*\*\*\*\*  
**NOTE: All silverbrazed piping, including low pressure systems, should be cleaned to preclude corrosion from residual brazing flux.**  
\*\*\*\*\*

Clean silverbrazed piping to remove residual flux remaining in the system after fabrication. Use one of the procedures below. The hot flush and hot recirculating flush are preferred. Minimum flow rate through any part of the system in liters per second shall be 0.0037 times the inside diameter of the pipe in mm. For any flushing method used, the system shall be full of water so that joints are completely submerged at all times.

### 3.2.1 Hot Flushing Method

Hot flush the system for one hour using heated fresh water. No part of the system shall go below 43 degrees C.

### 3.2.2 Hot Recirculating Flush Method

Perform hot recirculating flush for one hour. Heat water during flushing so that no part of the system falls below 43 degrees C. After completing the hot recirculating flush, flush the system with cold fresh water for 15 minutes.

### 3.2.3 Cold Soak Method

Cold soak the system using fresh water at not less than 15.50 degrees C for 12 hours. Following the 12 hour soak, flush the system with fresh water at not less than 15.50 degrees C for 4 hours.

## 3.3 FIELD QUALITY CONTROL

### 3.3.1 Examinations

#### 3.3.1.1 Welding Examinations

[The Contractor shall] [The Government will] perform visual examinations to

detect surface and internal discontinuities in completed welds. Visually examine all welds. When examination indicates defects in a weld joint, the weld shall be repaired by a qualified welder. Remove and replace defects as specified in ASME B31.1, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Whenever a defect is removed, and repair by welding is not required, blend the affected area into the surrounding surface, eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, examine the area by the same methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. Any indication of a defect shall be regarded as a defect unless reevaluation by surface conditioning and reexamination shows that no unacceptable defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

### 3.3.1.2 Brazing Examinations

The Contractor shall perform brazing examinations. Visually examine all compressed air systems as follows:

- a. Check brazed joint fit-up. Diametrical clearances shall conform to brazing procedure requirements.
- b. Check base material of pipe and fitting for conformance to the applicable drawing or specification.
- c. Check grade of brazing alloy for conformance to the brazing procedure before fit-up or brazing.
- d. Check completed brazed joint for a complete ring of brazing alloy between the outside surface of the pipe and the face of the fitting, and for a visible fillet.
- e. Check stainless steel and other susceptible material for evidence of stress cracks. Check inside of joint if possible with borescope or other aids.

Defective joints may be repaired. However, no more than two attempts to repair by reheating and additional face feeding of brazing filler metal will be permitted, after which the defective joint shall be unsweated, reprepared as a new joint, examined for defects on pipe and fittings, and rebrazed.

### 3.3.2 Testing

\*\*\*\*\*

**NOTE: If air (pressure) drop tests are used for system acceptance, assure leakages at acceptable rates through valves (or other components) are not causing pressure drop. Most hard-seated valves have some allowable leakage rate (about 10 cubic centimeters per hour of water per 25 mm of valve size or 3 liters per hour of gas per mm of valve**

size). Delete check for cross-connection if only one type of system is involved in project.

\*\*\*\*\*

3.3.2.1 General Requirements, Testing

Perform testing after cleaning. Contractor shall provide everything required for tests. Tests shall be subject to the approval of the Contracting Officer. Calibrate the test pressure gages with a dead weight tester within [15] [\_\_\_\_\_] days before use and certify by initial and date on a sticker applied to dial face. [Pressurize each piping system individually and check to assure that there are no cross-connections between different systems prior to hydrostatic and operational tests.]

3.3.2.2 Hydrostatic Tests and Leak Tightness Tests

a. Preliminary Preparation

Remove or isolate from the system the compressor, air dryer, filters, instruments, and equipment which would be damaged by water during hydrostatic tests and reinstall after successful completion of tests.

b. Performance of Hydrostatic Tests

\*\*\*\*\*

**NOTE: Specify or show on the drawings the design working pressure of each system in the project.**

\*\*\*\*\*

Hydrostatically test piping systems in accordance with ASME B31.1. Vent or flush air from the piping system. Pressurize system for 10 minutes with water at one and one-half times design working pressure, then reduce to design working pressure and check for leaks and weeps.

c. Compressed Air Leak Test

After satisfactory completion of hydrostatic pressure test, blow systems dry with clean, oil-free compressed air, and test with clean, dry air at design working pressure. Brush joints with soapy water solution to check for leaks. Install a calibrated test pressure gage in piping system to observe any loss in pressure. Maintain required test pressure for a sufficient length of time to enable an inspection of joints and connections.

3.3.2.3 Operational Tests

Test equipment as in service to determine compliance with contract requirements and warranty. During the tests, test equipment under every condition of operation. Test safety controls to demonstrate performance of their required function. Completely test system for compliance with specifications.

3.4 INSTRUCTION TO GOVERNMENT PERSONNEL

Provide [2] [\_\_\_\_\_] man-days of instruction to [2] [\_\_\_\_\_] Government

personnel in accordance with Section 15050, "Basic Mechanical Materials and Methods" for each type of compressor and compressed air dryer in the project.

-- End of Section --