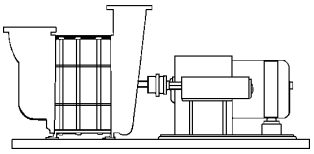
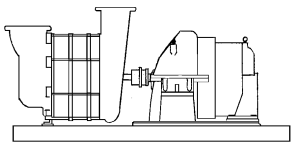
Chapter 3

Compressors

Air Compressors *(AC)*

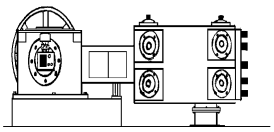
For plant or instrument air.

For all air compressors, capacity is at inlet temperature and pressure.

Description	*Type*
Packaged unit including motor driver. **Includes inlet air filter, inlet throttle valve, bypass throttle valve, bypass silencer, compressor*, intercoolers**, aftercooler, automatic condensate removal system with condensate bypass valve, lube oil system, continuous baseplate, spacer coupling and guard, induction motor, vibration shutdown system, protection and regulation system, compressor mechanical test run and check valve.** *** The nominal 110 PSIG discharge machines have four stages of compression. The nominal 325 PSIG discharge machines have five stages of compression.** **** The four stage machines have three intercoolers. The five stage machines have four intercoolers.** *Material Selection:* ***CS*, CI (Cast iron)** *Actual* **Capacity: 1,000 - 25,000 CFM [1,700M - 42,400 3/H]** *Exit Pressure - Gauge:* **15 - 325 PSIG [104 - 2,258 KPA]** *Inlet Temperature:* **-50 - 200 DEG F [-45 - 90 DEG C]; Default: *68* DEG F [*20* DEG C]** *Inlet Pressure - Gauge:* **Default: *0* PSIG [*0* KPA]**	▫▫▫▫▫▫▫▫▫ 
Packaged unit including turbine driver. **Includes the same items as ▫▫▫▫▫▫▫▫▫ except the compressor driver is a steam turbine instead of AC induction motor.** *Material Selection:* ***CS*, CI (Cast iron)** *Actual* **Capacity: 1000 - 25000 CFM [1,700 - 4,200 M3/H]** *Exit Pressure - Gauge:* **15 - 325 PSIG [105 - 2,240 KPA]** *Inlet Temperature:* **-50 - 200 DEG F [-45 - 90 DEG C]; Default: *68* DEG F [*20* DEG C]** *Inlet Pressure - Gauge:* **Default: *0* PSIG [*0* KPA]**	▫▫▫▫▫▫▫▫▫ 

Air Compressors (AC) - continued

Description	Type
Integral gasoline engine driver, base plate, coupling, reciprocating gas compressor for compression of large volumes of air to high pressure, less coolers, filters, condensate removal (not a packaged unit). *Mat'l of Construction:* ***CS*** *Exit Pressure - Gauge:* **Max: 6,000 PSIG [41,300 KPA]** *Driver Power:* **100 - 10000 HP [75 - 7100 KW]** *Inlet Temperature:* **Default: *68* DEG F [*20* DEG C]** *Inlet Pressure - Gauge:* **Default: *0* PSIG [*0* KPA]**	▫▫▫▫▫▫▫▫▫
Motor driven reciprocating gas compressor, with speed reducer, pulsation dampers for compression of large volumes of air to high pressure, less coolers, filters, condensate removal (not a packaged unit). *Mat'l of Construction:* ***CS*** *Exit Pressure - Gauge:* **Max: 6,000 PSIG [41,300 KPA]** *Driver Power:* **Max: 15,000 HP [11,000 KW]** *Inlet Pressure - Gauge:* **Default: *68* PSIG [*20* KPA]**	▫▫▫▫▫▫▫▫▫▫
Single stage, non-lubricated, packaged reciprocating compressor for oil-free air; includes motor and drive, coupling, base plate, cooler. *Mat'l of Construction:* ***CS*** *Actual Capacity:* **75 - 1,100 CFM [130 - 1,850 M3/H]** *Exit Pressure - Gauge:* **90 - 150 PSIG [620 - 1,000 KPA]** *Inlet Temperature:* **-50 - 200 DEG F [-45 - 90 DEG C]; Default: *68* DEG F [*20* DEG C]** *Inlet Pressure - Gauge:* **Default:*0* PSIG [*0* KPA]**	▫▫▫▫▫▫▫▫▫▫
Two stage, non-lubricated, packaged reciprocating air compressor for oil-free air; includes motor and drive, coupling, base plate, and cooler. *Mat'l of Construction:* ***CS*** *Actual Capacity:* **80 - 700 CFM [140 - 1,150 M3/H]** *Exit Pressure - Gauge:* **150 - 500 PSIG [1,040 - 3,400 KPA]** *Inlet Temperature:* **-50 - 200 DEC F [-45 - 90 DEG C]; Default: *68* DEG F [*20* KPA]** *Inlet Pressure - Gauge:* **Default: *0* PSIG [*0* KPA]**	▫▫▫▫▫▫▫▫▫▫

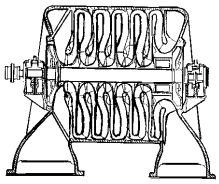


*G*as Compressors *(GC)*

For process gas streams:

- **Centrifugal (motor, turbine, gasoline engine, no driver)**
- **Reciprocating (motor, turbine, no driver) - with gear reducer, couplings, guards, base plate, compressor unit, fittings, interconnecting piping, vendor-supplied instruments, lube/seal system; less intercoolers and interstage knock-out drums.**

For all gas compressors, capacity is at inlet temperature and pressure.

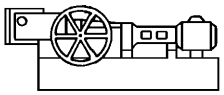
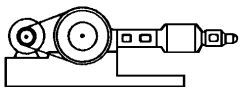
Description	*Type*
Axial (inline) centrifugal gas compressor with driver (motor, turbine or gasoline driven engine); excluding intercoolers and knock-out drums.	▫▫▫▫▫▫▫ 

Cas*ing Material:* See "Casting Materials" in Chapter 28 for a complete list of materials. Default: *CS*.
Act*ual* Capa*city:* 500 - 200000 CFM [850 - 339000 M3/H]
In*let* T*emperature:* -200 - 200 DEG F [-125 - 90 DEG C]; Default - *68* DEG F [*20* DEG C]
Exi*t* Press*ure* - G*auge:* Max: 2000 PSIG [13750 KPA]
Mo*lecular* W*eight:* Default: *29*
Spe*cific* H*eat* R*atio:* Default: *1.4*
In*let* Compr*. Factor:* Default: *1*
Out*let* Compr*. Factor:* Default: *1*
Ma*x* In*terstage* T*emp:* Specify the maximum temperature reached during compression before inter-cooling. Max: 400 DEG F [200 DEG C]; Default: *350* DEG F [*175* DEG C]
In*tercooler* Ou*t* T*emp:* Specify the interstage inlet temperature after cooling. -50 - 150 DEG F [-45 - 65 DEG C]; Default: *90* DEG F [*30* DEG C]
Dri*ver* Ty*pe* Sy*mbol:* Default: *NONE*
NONE - No driver
GAS ENGINE - Gas engine driver
MOTOR - Motor driver
TURBINE - Turbine driver
Tur*bine* P*ress*. - G*auge:* Max: 1,600 PSIG [11,000 KPA]; Default: *300* PSIG [*2050 KPA]
Gear R*educer* Sy*mbol:* Default: gear reducer included if driver type specified; otherwise none.
YES - Gear reducer required
NO - No gear reducer
Lu*be* O*il* Sy*stem:* Default: *YES*
YES - Lube system required
NO - No lube oil system

Gas Compressors (GC) - continued

Description	Type
Integral gear centrifugal gas compressor with driver (motor, turbine or gasoline engine), scrolls (inter-stage piping), bull gear, coupling, guard; may include lube oil system, intercoolers, aftercooler: excludes filter and silencers. **Casing Material: See "Casting Materials" in Chapter 28 for a complete list of materials. Default: *CS*.** **Actual Capacity: 500 - 70,000 CFM [850 - 118,900 M3/H]** **Inlet Pressure - Gauge: -0.4 -100 PSIG [-2.7 - 689 KPA]; Default: *0.0* PSIG [*0.0* KPA]** **Inlet Temperature: 32 - 200 DEG F [0 - 90 DEG C]; Default: *68* DEG F [*20* DEG C]** **Exit Pressure - Gauge: Max: 700 PSIG [4825 KPA]** **Exit Temperature: -200 - 200 DEG F [-125 - 90 DEG C]** **No of Impellers: 2 - 4** **Gas Type Option: Sets default gas properties and makes adjustments for explosive gases. Default: *AIR*.** **AIR - Air** **O2GAS - Oxygen** **N2GAS - Nitrogen** **ARGAS - Argon** **FLGAS - Flammable gas** **NONFL - Non-flammable gas** **Molecular Weight: Default based on chosen gas type.** **Specific Heat Ratio: Default based on chosen gas type.** **Inlet Compr. Factor: Default: *1.0*.** **Outlet Compr. Factor: Default: *1.0*.** **Inter-Cooler Reqd: Default: *YES*** **YES - Cooler required** **NO - None required** **After-Cooler Reqd: Default: *NO*.** **YES - Cooler required** **NO - None required** **Max Interstage Temp.: Specify the maximum temperature reached during compression before inter-cooling. Max: 400 DEG F [200 DEG C].** **Intercooler Out Temp: The interstage inlet temperature after intercooling. - 5- - 150 DEG F [-45 - 65 DEG C]; Default: *90* DEG F [*30* DEG C].** **Driver Type: Default: *NONE*** **NONE - No driver** **GAS ENGINE - Gas engine driver** **MOTOR - Motor driver** **TURBINE - Turbine driver** **Turbine Press. - Gauge: Max: 1,600 PSIG [11,000 KPA]; Default: *300* PSIG [*2,050* KPA].** **Lube Oil System: Default: *YES*** **YES - Lube system required** **NO - No lube oil system** **Shop Assembly Option: Partial assembly denotes multiple skids field connected wither intercoolers. Default: *FULL*.** **FULL - Full shop assembly** **PART - Part shop assembly** **NONE - No shop assembly**	▫▫▫▫▫▫▫▫▫▫

Gas Compressors (GC) - continued

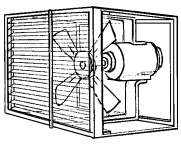
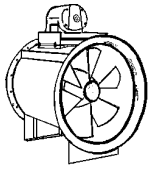
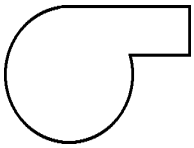
Description	*Type*	
Reciprocating gasoline engine drive includes integral gas engine driver, gear reducer, baseplate, coupling, interstage pots and coolers. *Mat'l of Construction:* ***CS*** *Exit Pressure - Gauge:* **Max: 6,000 PSIG [4,100 KPA]** *Driver Power:* **Not specified** *Inlet Temperature:* **Default: *68* DEC F [*20* DEG C]**	▫▫▫▫▫▫▫▫▫	
Motor or turbine-driven reciprocating process gas compressor. Includes motor, gear reducer and pulsation dampers. Does not include intercoolers or aftercoolers. *Actual Capacity:* **Max: 200,000 CFM [339,000 M3/H]** *Inlet Temperature:* **-200 - 200 DEG F [-125 - 90 DEG C]; Default: *68* DEG F [*20* DEG C]** *Exit Pressure - Gauge:* **Max: 6,000 PSIG [41,000 KPA]** *Molecular Weight:* **Default: *30*** *Specific Heat Ratio:* **Default: *1.22*** *Inlet Compr. Factor:* **Default: *1.0*** *Outlet Compr. Factor:* **Default: *1.0*** *Max Interstage Temp:* **Specify the maximum temperature reached during compression before inter-cooling. Max: 400 DEG F [200 DEG C]; Default: *270* DEG F [135 DEG C].** *Intercooler Out Temp:* **The interstage inlet temperature after intercooling. -50 - 150 DEG F [-45 - 65 DEG C]; Default: *95* DEG F [*35* DEG C].** *Driver Type:* **Default: *NONE*** **NONE - No driver** **MOTOR - Motor driver** **TURBINE - Turbine driver** *Turbine Press. - Gauge:* **Max: 1,600 PSIG [11,000 KPA]; Default: *300* PSIG [*2,050* KPA]** *Gear Reducer Symbol:* **Default: gear reducer included if driver type specified, otherwise none.** **YES - Gear reducer required** **NO - No gear reducer** *Lube Oil System:* **Default: *YES*** **YES - Lube system required** **NO - No lube oil system**	▫▫▫▫▫▫▫▫▫▫	

Fans, Blowers (FN)

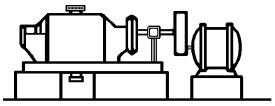
The distinction between the terms fan, blower and compressor is confusing; however, a distinction may be made based upon the mechanical construction of the machine and the pressure rise from inlet to outlet produced by the machine.

The Air Moving and Conditioning Association, Incorporated (AMCA) has made 12.25 INCHES of water pressure rise the cut-off between fans and blowers. Assuming an inlet pressure of 0 PSIG, a 12.25 INCHES of water pressure rise corresponds to a compression ratio of 1.3. Machinery used for compression ratios greater than 1.03 are called blowers or compressors. A pressure of 12.25 INCHES of water corresponds to 0.44 PSIG. It is common practice, however, to call any centrifugal gas-moving machine a fan if its construction is of sheet metal and the rotating element is wheel rather than an impeller. Single-stage fans are made with pressure rises of 50 INCHES of water, and two-stage fans with pressure rises up to 100 INCHES of water. Centrifugal blowers (or turbo-blowers) are primarily of cast iron construction and the rotating element is an impeller. Centrifugal blowers normally produce pressure rises in the range of 1 to 40 PSI. Centrifugal blowers may be single- (one impeller) or multi-stage (two or more impellers). A gas-moving machine that produces a pressure rise of more than 40 PSI is called a compressor. Another difference between compressors and blowers is that the design pressure of a blower is never more than 100 PSIG, while compressors are frequently designed for more than 100 PSIG. It should be noted, however, that in the range of 1 to 40 PSI pressure rise with a design pressure less than 100 PSIG, the terms are used interchangeably.

With driver, listed in ascending capacity.

Description	*Type*
Propeller fan. *Mat'l of Construction:* ***CS*** *Actual Capacity:* **1,000 - 15,000 CFM [1,700 - 25,400 M3/H]**	▫▫▫▫▫▫▫▫▫▫ 
Vaneaxial fan. *Mat'l of Construction:* ***CS*** *Actual Capacity:* **2,300 - 40,000 CFM [3.950 - 67,900 M3/H]**	▫▫▫▫▫▫▫▫▫▫ 
Centrifugal fan. **Applications include: pulling a gas stream through a baghouse, supplying combustion air to boilers and furnaces, boosting the pressure of the combustion gases from a boiler to push the gasses up the boiler stack, pneumatic conveying, solids drying and classifying and ventilation.** **Centrifugal fans are used to move gas through a low pressure drop system. The maximum pressure rise across a centrifugal fan is about 2 PSI. The most typical materials of construction are carbon steel sheet or plate casing, aluminum or carbon steel wheel (or impeller) and carbon steel shaft. Fans may be fabricated from a variety of other materials such as stainless steel and FRP. Centrifugal fans are classified according to the design of the wheel. The different wheels are: radial blade type, forward-curved, backward-curved, backward-inclined and airfoil. Centrifugal fans are manufactured in sizes that range from less than 100 CFM to 1,000,000 CFM.** *Mat'l of Construction:* ***CS*** *Actual Capacity:* **700 - 150,000 CFM [1,200 - 254,800 M3/H]** *Exit Pressure- Gauge:* **0 - 15 IN H2O [0 - 3,700 PA];** **Default: *6* IN H2O [*1,500* PA]**	▫▫▫▫▫▫▫ 

Fans, Blowers (FN) - continued

Description	*Type*
Rotary blower. This general purpose blower includes inlet and discharge silencers. Applications include: pneumatic conveying, combustion air, exhausting vapors, instrument air and aeration of fluids **A rotary blower is a positive displacement machine. That is, a constant volume of inlet air (or other gas) is compressed regardless of any changes in the discharge pressure required by the system. The rotary blower moves air in the following manner. Two figure eight shaped impellers are mounted on parallel shafts inside a casing and rotate in opposite directions. As each impeller passes the blower inlet a volume of gas is trapped, carried through to the blower discharge and expelled against the discharge pressure. The casing of the rotary blower is cast iron and the impellers are ductile iron. Rotary blowers are manufactured in standard sizes.** *Mat'l of Construction:* ***CS*** *Actual Capacity:* **100 - 4,000 CFM [170 - 6,700 M3/H]** *Exit Pressure - Gauge:* **2 - 15 PSIG [15 - 100 KPA]; Default: *8* PSIG [*55* KPA]** *Speed:* **900 - 3,600 RPM**	▫▫▫▫▫▫▫▫▫▫ 
Single or multi-stage centrifugal turbo blower. Heavy duty, low noise blower. For moving up to 150,000 CFM of air or other gas through a system with a pressure drop from 1 to 10 PSI. Typical applications include: supplying air to wastewater treatment plant aeration basins; supplying air to blast furnaces, cupolas and converters; pneumatic conveying and supplying combustion air. This item is a centrifugal turbo blower. *Mat'l of Construction:* ***CS*** *Actual Capacity:* **100 - 40,000 CFM [170 - 67,950 M3/H]** *Exit Pressure - Gauge:* **0.5 - 30.0 PSIG [3.5 - 205 KPA]** *Speed:* **900 - 3,600 RPM**	▫▫▫▫▫▫▫▫▫▫