

SCFS User Instruction Manual



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Mako Compressors

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GENERAL INFORMATION.

These units are for filling Self Contained Breathing Apparatus (SCBA) or Self Contained Underwater Breathing Apparatus (SCUBA) with atmospheric air and are not suitable for use with any other gasses. They are designed and manufactured to give optimum performance with long life and reliability.

This manual gives the end user all the information required to install and operate this unit in a safe and efficient manner.

Servicing facilities and the supply of genuine MAKO replacement parts are provided through a worldwide network of MAKO Distributors. If replacement parts are needed, the user should first contact the local MAKO Distributor. If there is any difficulty contacting a local distributor the end user may contact the MAKO factory representative.

The information given in this manual was correct at the time of it's creation. However, as part of continuous development, modifications to parts and procedures may be made without notice that could affect the maintenance requirements of this unit. Before any service or maintenance work is undertaken the user is advised to contact the local MAKO Distributor who is supplied with revised and up-dated information.

In any communication concerning these units it is essential to quote the MODEL, SERIAL NUMBER and the YEAR of MANUFACTURE. This information is located on the units' nameplate. (see Fig. 1.3-1)

Throughout this manual all pressures quoted are gauge pressures unless otherwise stated.

Manual Configuration

This manual is broken down by numbered chapters, sections and subsections shown in bold text and separated by periods.

(Chapter #).(Section #).(subsection #).(subsection #)

4.3.2.1 would represent subsection 1 of subsection 2 of section 3 of chapter 4

There can be as many subsections as are needed.

Within this structure could be **headings** in bold which are not numbered.

The pages are designated by chapter and page separated by a dash.

(Chapter #)-(Page number within that chapter)

4-3 would indicate the third page of chapter four.

All illustrations are designated by chapter, section and subsection to which they are associated followed by the number of the illustration separated by a dash

fig.(chapter and section designation)-(number of the illustration within the section indicated)

fig. 4.3.2.1-3 would indicate the third illustration within section **4.3.2.1**

Maintenance

To ensure the continued trouble-free operation of this unit it is important that periodic maintenance and servicing is carried out in accordance with the information given in the 'Maintenance' section of this manual. To assist in this matter your local MAKO Distributor can provide a number of optional maintenance agreements to suit your requirements. These agreements provide the end user with the expertise of our factory trained technicians and the guarantee that only Genuine MAKO parts will be used.

Warranty

The conditions of the MAKO Warranty are set out in the Company's standard Conditions of Sale available from the MAKO Distributor supplying the unit.

**USE ONLY GENUINE MAKO PARTS. YOUR
WARRANTY COULD BE AFFECTED IF ANY SERVICE
OR REPAIR IS CARRIED OUT USING ANYTHING
BUT GENUINE MAKO PARTS.**



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Mako is part of the
 **CompAir** Group

DECLARATION OF CONFORMITY

Applicant:

CompAir USA Inc.
1634 SW 17th Street
Ocala, FL 34471 USA

Factory:

CompAir USA Inc.
1634 SW 17th Street
Ocala, FL 34474 USA

Machinery Description:

Compressors & High Pressure Air Equipment

Model/Type Number:

MK X AM
MK X CI
MK X H3
MK X H6
MK X MK
MK X VS

MK Series as listed:

MK X AC	
MK X HI	MK X SC
MK X H5	MK X SJ
MK X H9	MK X MJ
MK X MC	MK X HI
MK X VI	MK X HS

I hereby declare that the machinery complies with the Essential Health and Safety Requirements of the Machinery Directive (98/37/EC) as amended and with the provisions of the Electromagnetic Compatibility Directive (89/336/EEC) as amended.

EMC Standards:

Emissions: EN61000-4:2001
Immunity: EN61000-6-2:2001

Machinery Standards:

EN ISO 12100-1,-2
EN 60204-1
EN 1050



Engineering Manager

4-13-07

Date

Ocala, FL

Location

1. Forward

1.1 Notes On The Unit

MAKO units are the result of many years of research and development. This experience combined with high quality standards guarantee the manufacture of breathing air charging systems which will provide a long service life, high reliability and cost-effective operation.

Certificate Of Conformity

This unit and its accessories as supplied by MAKO conform to the basic health and safety requirements included in the Machinery Directive 98/37/EC and the EMC Directive 89/336/EEC. The compliance with these directives is signified by the "CE mark" (See fig. 1.1-1)



fig. 1.1-1 CE

1.2 Intended Use

This unit has been constructed in accordance with state-of-the-art technology and recognized safety regulations. Nevertheless, its use may constitute a risk to life and limb of the user or third persons or cause damage to the machine or to other material property, if

- it is not used as intended,
- it is operated by unqualified personnel
- it is improperly modified or changed
- the safety regulations are not observed

Therefore, any person entrusted with the operation, maintenance or repair of this unit must read and follow all safety regulations in this manual. If required, this has to be acknowledged by signature.

in addition,

- relevant accident prevention regulations
 - generally recognized safety regulations
 - national safety regulations
- have to be observed.

This system must be operated under technically perfect conditions and in accordance with its intended use and the instructions set out in the operating manual. This system must be operated only by safety-conscious personnel who are fully aware of the dangers involved in the operation of this system. If any functional problem is detected or suspected stop the operation of this system. Report the problem to the appropriate maintenance or service personnel. The problem must be resolved before the system is returned to operation.

Operating the unit within the limits of its intended use also involves observing the instructions set out in the operating manual and complying with the inspection and maintenance directives.

1.3 Maintenance

Carefully performed maintenance is imperative, this ensures that your unit can meet all the requirements for which it was intended. It is therefore imperative to adhere to the specified maintenance intervals and to carry out the maintenance work with deliberate care, especially when the unit is utilized under harsh operating conditions.

Servicing

Please contact your authorized MAKO distributor in the case of malfunctions or when spare parts are required. Our fully trained personnel will ensure that all repairs are carried out properly. Using only genuine MAKO spare parts. Genuine MAKO spare parts are manufactured utilizing state-of-the-art technology, thus guaranteeing the continued reliable performance of the unit.

1. Forward

  www.makocompressors.com Mako Compressors 1301 N. Euclid Ave. Princeton, IL 61356 Ph. (877) 272-1675 Fx. (217) 224-7814  www.compair.com	ModelNumber, Numerodumodele, Modellnummer, NumeroModello, N° modello SerialNumber, Numerodeserie, Seriennummer, Numerodimaticola, N° serie		
	DateofManufacture, Datedefabrication, Produktionsdatum, Datadifabbricazione, Fecha defabricacion		
	Workorder, Bondetravail, Arbeitsauftrag, Pedido, Ordinedilavoro		
	HP, ch, PS, CV	KW	V
	~	Hz	A
Diagramnumber, Nombradenimber, Diagramm-Zahl, Numerodeloschema, Numerodeldiagrama			
MotorRPM Moteurr/min MotorU/min Motoregiri/min	CompressorRPM, Compresseur/min, KompressorU/min, Compresoregiri/min, CompresorRPM		
Pressure Pression Druck Pressione Presion	PSI BAR bar Bar	ChargingRate RegimedeCharge Ladegeschwindigkeit Velocidadcarga Capacidaddecarga	
PurificationPN ReinigungTN Purificazionepn PurificacionPN	CartridgeNumber Numerodecartouche Einsatz-Nummer Numerocartuccia N°cartucho	1. 2. 3.	

  MAKO Compressors 1301N. Euclid Ave Princeton, IL 61356 Ph. (877) 272-1675 Fx. (217) 224-7814 www.makocompressors.com 	Compressor Model Number: _____
	Compressor Serial Number: _____
	Date of Manufacturer: _____ Work Order: _____
	HP: _____ KW _____ FLA: _____
	Phase: _____
	Voltage: (VAC) _____ Motor RPM: _____ Hz: _____
	SCCR: _____ AMPS Diagram Number: _____
	Pressure: _____ PSI _____ BAR
	Charging Rate: _____ CFM _____ M ³ /Hr
	Compressor RPM: _____
Purification PN: _____ Cartridge1 PN: _____	
Cartridge2 PN: _____ Cartridge3 PN: _____	

fig. 1.3-1 MAKO Nameplates

In Case Of Queries

Please enter the data on the nameplate of your unit into the nameplate shown in (fig. 1.3-1). In the case of queries or spare parts orders, please refer to the units series & type as indicated on the nameplate, the identification no. and the year of construction.

1.4 Notes

General

These operating instructions are intended to familiarize the user with the unit and its intended use. The instructions contain important notes on how to operate the unit safely and cost-effectively.

Observing these instructions will help to avoid risks, reduce repair costs, down times and to increase the reliability and service life of the unit.

The operating instructions in this manual are in addition to any applicable local, regional or national, laws, rules and regulations regarding the prevention of accidents and environmental protection. They must always be available at the location of the unit. The operating instructions must be read and followed by any person carrying out work in connection with the unit, i.e. operation, setting up, disposal of any waste and consumables, maintenance, inspection, repair, and transport.

1. Forward

Guarantee

Operate this unit only if you have an exact knowledge of the machine taking into respect these facts.

MAKO cannot be held responsible for the safe operation of the unit if it is used in a manner that does not correspond to the intended use, or for other applications which are not mentioned in this manual.

Warranty claims will not be accepted in the case of

- Operating errors
- Incorrect maintenance
- Wrong auxiliary materials
- Use of spare parts other than genuine MAKO spare parts
- Modifications and changes to the installation

The warranty and liability conditions of the general terms and conditions of MAKO will not be extended by the notes above.

Any unauthorized change to this unit, or the installation of components not accepted by the manufacturer (i.e. fine separator) will result in the withdrawal of the CE mark. As a consequence, any liability and warranty claims will not be accepted by the manufacturer.

Safety Regulations

Danger!

The safety regulations in chapter 3 of the operating instructions must be strictly observed.

Technical Changes

In the course of technical development we reserve the right to modify the units without further notice.

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3. Safety regulations

3.1 Identification Of Safety Guidelines

MAKO is not liable for any damage or injury resulting from the non-observance of these safety instructions or negligence of the usual care and attention required during installation, handling, operation, maintenance or repair, even if this is not explicitly mentioned in these operating instructions.

If any of the regulations contained in these instructions - especially with regard to safety - does not correspond to the local legal provisions, the stricter of both shall prevail.

Danger!

Passages marked with this designation indicate a possible danger to personnel.

Important!

Passages marked with this designation indicate possible damage to unit.

Note.

Passages marked with this designation provide technical or procedural information for the optimal cost-effective use of the unit.

3.2 General Safety Instructions

Organizational Measures

The operating instructions must always be at hand at the place of operation of the unit!

In addition to the operating instructions, all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection must be adhered to and passed on to others! These compulsory regulations may also deal with the handling of hazardous materials or the issuing/wearing of personal protective equipment, or traffic regulations.

Instructions, including supervisory responsibility and duty of notification for taking into account in-plant factors, for example regarding work organization, sequences of operations, personnel assigned to certain tasks, are to be kept with the operating manual.

The personnel entrusted with the operation and/or maintenance of the unit must have read the operating instructions and in particular the chapter on safety regulations before starting work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. for setting up or maintenance.

Supervisors should check on a regular basis that the personnel are carrying out the work in compliance with the operating instructions and that they are paying attention to the safety requirements!

Observe all safety and warning notices attached to the unit!

See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.

In the case of safety-relevant changes to the unit or its operating behavior, stop the unit immediately and report the fault to the responsible department or person!

Spare parts must always be genuine MAKO spare parts.

High pressure hoses have to be changed within stipulated and periodic intervals, even if no safety-relevant faults have been detected.

Adhere to prescribed intervals or those specified in the operating instructions for routine checks and inspections!

3. Safety regulations

For the execution of maintenance work, tools and workshop equipment adapted to the task at hand are absolutely necessary.

The personnel must be made familiar with the location and operation of fire extinguishers! Observe all fire-warning and fire-fighting procedures!

Selection And Qualification Of Personnel; Basic Responsibilities

Work on or with the unit must be carried out by reliable personnel only. Statutory minimum age limits must be observed!

Employ only trained or instructed personnel and clearly set out the individual limits and responsibilities of the personnel for operation, set-up, maintenance and repair!

Ensure that only authorized personnel work on or with the unit!

Define the machine operator's responsibilities giving the operator the authority to refuse instructions by third persons that are contrary to safety regulations.

Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the unit without being continuously supervised by an experienced person!

Work on the electrical equipment of the unit must be carried out only by a skilled electrician in accordance with electrical engineering rules and regulations.

Work on system elements such as high pressure hoses may only be carried out by personnel with special knowledge and experience.

3.3 Changes And Modifications To The Unit

Do not make any changes, modifications or attachments to the unit, which could affect safety, without the supplier's prior permission!

Unauthorized changes to the machine are not permitted for safety reasons.

Genuine MAKO parts were especially designed and selected for this unit. The installation and/or use of any parts other than genuine MAKO parts can therefore affect the active and/or passive safety and reliability of this unit.

The manufacturer is not liable for damage resulting from the use of non-genuine MAKO parts or special accessories. This applies also to the installation and setting of safety equipment and valves as well as to welding on structural or pressurized parts.

3.4 Installation And Normal Operation

In addition to the general technical operation in accordance with the stipulations of the local authorities, we would like to refer in particular to the following regulations.

For the lifting of this unit, a suitable lifting mechanism is to be used, which meets the local safety regulations. All loose or moveable parts must be safely secured before the unit can be lifted. It is strictly prohibited to stay in the danger zone of a lifted load.

The correct method of lifting (according to the operating instructions of the load suspension device) has to be ensured.

All blind flanges, plugs, caps and bags with drying agent have to be removed prior to the installation of the pipes. Distributing pipes and pipe connections have to be of the proper size and suitable for the relevant operating pressure.

The system has to be installed in such a way that it is adequately accessible.

3. Safety regulations

The installed unit-specific safety valves only assume the pressure safeguarding function of this unit provided in currently valid standards and regulations.

Electrical connections must meet the local regulations. Power units must be connected to earth and protected from short-circuits by means of fuses.

Normal Operation

The inlet pressure rating and the fill pressure set points of the unit can be located on the nameplate of the unit.

Take the necessary precautions to ensure that the unit is used only when in a safe and reliable condition!

Operate the machine only when all protective equipment are in place and fully functional!

Check regularly that

- all means of protection are correctly fitted and fixed.
- all hoses and/or pipes within the system are in good condition, firmly fixed and do not chafe.
- there are no leaks.
- all fittings are firmly tightened.
- all wires are connected correctly and are in good condition.
- all safety valves and other pressure relief mechanisms are in good order and not blocked by e.g. dirt or paint.
- the safety mechanisms are fully functional.

All air hoses are of the proper size and suitable for the relevant operating pressure. Do not use chafed or damaged hoses.

Only use hose couplings and fittings of the right type and the correct size.

Before blowing through a hose or an air pipe ensure that the open end is positively held. A free end whips and can cause injuries.

Before loosening or disconnecting any connection ensure that it is not under pressure.

Refrain from any working method which is doubtful in terms of safety.

Never play around with compressed air from this unit!

Never aim compressed air from this unit at yourself or at any other person!

Never use compressed air from this unit to clean your clothing.

Never use compressed air from this unit to clean equipment.

3. Safety regulations

Never operate the system at pressures which exceed the inlet pressure or fill pressure(s) as stated on the units nameplate.

All access panels have to be closed at all times during the operation of this unit.

Check the unit at the beginning of each startup and at least once every 8 hours of operation for visible damage or problems. Report any problems or changes in the machine's operating behavior to the responsible department or person immediately. In the case of any problem which might effect the safe operation of this unit, stop the unit immediately! Have any problem resolved before restarting the unit!

Follow the operating procedures according to the operating instructions.

3.5 Special Work/Maintenance

Follow the adjusting, maintenance and inspection activities and schedule set out in the operating instructions, including information on the replacement of parts and equipment. These activities must only be carried out by skilled personnel, under qualified supervision.

Brief the personnel operating the unit prior to starting any special operations or maintenance work! Appoint a person to supervise the activities!

Maintenance and repair work may only be carried out under the supervision of a person who is qualified to do the work.

Inspection, maintenance and repair work may only be carried out with the unit being at rest and depressurized. Protective equipment to be removed for this work has to be properly refitted after completion of these activities.

The use of this unit without protective equipment is not permitted. During maintenance and repair when working on a running unit, working clothes have to be close-fitting.

Always use the correct tools for maintenance and repair work.

Never use inflammable solvents or carbon tetrachloride to clean parts. Take precautions against poisonous vapors from cleaning agents.

In any work concerning the operation, conversion or adjustment of the unit and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the operating procedures set out in the operating instructions and the information on maintenance work.

Ensure that the maintenance area is adequately secured.

3. Safety regulations

To lower the risk of accidents, individual parts and large assemblies being moved for replacement purposes should be carefully attached to lifting tackle and secured. Use only suitable and technically correct lifting gear and only utilize suspension systems with adequate lifting capacity. Never work or stand under suspended loads!

During maintenance and when carrying out repair work, cleanliness is very important. Avoid the ingress of dirt by covering parts and free openings with a clean cloth, paper or adhesive tape.

After the completion of each repair, check that no tooling, loose parts, cloth or debris have been left in the unit.

Care must be taken any time this unit is in use!

Maintenance And Repair

The employer has to inform the employee of the dangers possibly arising during the repair and maintenance of this unit as well as on how to avoid them; the employee has to observe all measures for safety at work. Safety equipment for the prevention or elimination of danger has to be maintained regularly and functionally checked at least once a year. Faults observed have to be immediately rectified and/or reported to the responsible person.

Use only genuine MAKO spare parts.

Before removing or opening pressurized components, positively isolate any source of pressure and depressurize the entire system.

Never weld or carry out any other work requiring heat near any components which may become Pressurized.

Never weld any pressure reservoir or change it in any way.

If work which produces heat, flames or sparks has to be carried out on or near this unit, the adjacent components of this unit have to be protected by means of non inflammable material.

Before releasing this unit for operation after maintenance or overhaul check that the unit is functioning properly and the regulating, shut-down equipment and safety interlocks are working properly.

Electrical components and regulating equipment have to be protected from the ingress of humidity when cleaning the system.

Never use etching solvents which could attack the materials used.

Avoid damage to the safety valves and other pressure reducing components. Check in particular for clogging caused by paint, oil carbon or the accumulation of dust, which could deteriorate the effectiveness of these components.

3. Safety regulations

Check the accuracy of pressure and temperature indicators at regular intervals. If the admissible tolerance limits have been exceeded, these devices must to be replaced.

Before removing or overhauling any equipment, ensure that all moveable parts are safely secured. After completion of repair work, always verify that no tools, loose parts or cloths have been left in or on the unit, units must be cycled several times in order to ensure that there are no mechanical faults in the unit.

The fastening of loads and the instructing of forklift or crane operators should be entrusted to experienced personnel only. The person giving the instructions must be within sight or voice contact with the operator.

For carrying out overhead assembly work always use specially designed or otherwise safety-orientated ladders and working platforms. Never use machine parts as a climbing aid. Wear a safety harness when carrying out maintenance work at greater heights.

Clean the machine, especially connections and threaded unions, of any traces of oil, fuel or preservatives before carrying out maintenance or repair work! Never use aggressive detergents! Use lint-free cleaning rags!

After cleaning, remove all covers and masking completely and allow the unit to dry before returning unit to service!

Always re-tighten screwed connections which have been loosened for maintenance and repair work.

If the set-up, maintenance or repairs require the removal of safety equipment, this equipment has to be replaced and checked immediately after these activities.

Ensure that replacement parts are disposed of in a safe and environmentally friendly manner in accordance with all applicable local, regional and national laws, rules and regulations.

3.6 Warning Of Special Dangers

Electric energy

Use only genuine MAKO fuses with the specified current rating. Switch off the machine/unit immediately if trouble occurs in the electric system.

Work on any electrical system or equipment must only be carried out by a skilled electrician or by specially instructed personnel under the control and supervision of such an electrician and in line with the relevant electrical engineering rules.

If regulations require, the power supply to parts of machines and plants on which inspection, maintenance and repair work is to be carried out must be cut off. Before starting any work, check the de-energized parts for the presence of power and ground or short-circuit them in addition to insulating adjacent live parts and elements.

The electrical equipment of this unit is to be inspected and checked at regular intervals. Defects such as loose connections or scorched cables must be rectified immediately.

3. Safety regulations

Necessary work on live parts and elements must be carried out in the presence of a second person who can cut off the power supply in case of danger by operating the main power switch.

Compressed-air lines must be laid and fitted properly. Ensure that no connections are exchanged. The fittings, lengths and quality of hoses must comply with the technical requirements.

Gas, Dust, Steam And Smoke

Carry out welding, flame-cutting and grinding work on the machine/unit only if this has been expressly authorized, as there may be a risk of explosion and fire.

Before carrying out welding, flame-cutting and grinding operations, clean the machine/unit and its surroundings from dust and other inflammable substances and make sure that the premises are adequately ventilated (risk of explosion)!

Adhere to the regulations valid for the place of operation!

Observe any existing national regulation if work is to be carried out in small rooms.

Pneumatics

Work on high pressure air equipment must only be carried out by persons with special knowledge and experience of high pressure air systems.

Check all lines, hoses and threaded connections regularly for leaks and obvious damage. Damage must be Repaired immediately. High pressure air may cause serious injury or death.

Depressurize all system sections, pressure pipes, tubing and hoses which are to be removed in accordance with the specific instructions for the assemblies concerned before carrying out any repair work.

3. Safety regulations

Rooms Subject To Explosion Hazards

Danger !

Units with any type of electrical components must never be operated in areas subject to explosion hazards!

(Exception: Special units with the corresponding technical modifications)

3. Safety regulations

3.7 Symbols And Explanations

The Following Symbols may be used on the unit.



fig. 3.7-1
No Access for Unauthorized Personnel



fig. 3.7-2
Warning, Electrical Shock or Electrocution



fig. 3.7-3
Warning, Pressurized Bottle



fig. 3.7-4
Read Operators Manual before continuing



fig. 3.7-5
Read Technical Manual before continuing



fig. 3.7-6
Warning! See the User Instruction Manual for specific hazards associated with this unit.
See the section of the users manual associated with this area of this unit for specific hazards associated with this area.

3. Safety regulations



fig. 3.7-7
Forklift, Left Most Lift Point



fig. 3.7-8
Forklift, Right Most Lift Point



fig. 3.7-9
Warning, Release of Pressure



fig. 3.7-10
Warning, Skin Puncture Danger

3.8 Logs And Daily Inspections

MAKO Supplies a daily log sheet, appendix-A, for used by the Operator. Make additional copies and create a daily log book. Keep this log with the unit at all times.

3.8.1 Daily Log Book

The daily log book should be checked before each session the unit is to be used.

Out of service

After any perceived problem the unit must be taken out of service and "Out Of Service" must be written in daily log along with a description of the problem.

Do not try to use the until the problem is resolved.

Report any such perceived problem to appropriate service personnel.

After problem is resolved the unit is put back in service, the resolution of the problem is documented, initialed and dated in the daily log.

3. Safety regulations

Daily Inspection & log Entries

1. - Check the log that no one has taken the unit out of service.

2. - After the unit is determined to be in service enter the date and time in the daily log and begin your inspections.

Walk around unit and look for problems.

- damaged tubing
- damaged fittings
- fill hoses that are damaged or worn.
- containment drawer not operating properly.
- any new undocumented damage of any kind.

If any problems are found that could effect the safe operation of the unit take the unit out of service and report the problem to service personnel.

Document any actions taken in daily log.

3. - All access panels must be in place.

4. - Place Your initials in the operator column.

5. - Unit can now be used.

6. - While unit is in use listen and look for air leaks. If an air leak is detected take the unit out of service. Report leak to the service personnel.

Danger!

High pressure air leaks can be very dangerous.

7. - Document any actions, concerns or observations in the "Comments" column of the daily Log.

8. - When unit is shut down record time out in the "comments" column

4. Layout and function



fig. 4.1-1

4.1 General Description

The Mako Stationary Containment Fill Station(SCFS) Units (See Fig. 4.1-1) incorporates all functions required to safely deliver high pressure breathing air to SCBA and SCUBA tanks.

1. - The regulation and control of high pressure breathing air from storage or the source to preclude SCBA / SCUBA over pressurization.
2. - The flexibility to control multiple banks of storage to allow the efficient filling of bottles through the use of a cascade filling procedure.
3. - The ability to monitor and control the filling of mobile storage units.
4. - The strength to protect personnel in the event of a catastrophic failure of a SCBA / SCUBA tank in the process of being filled.

Danger!

Do not use system for any application other than for breathing air system

MODEL	No. of CYLINDERS	Weight lb. / kg.
SCFS2	2	877 / 398
SCFS3	3	1390 / 630
SSCFS2	2	1077 / 489
SSCFS3	3	1590 / 721

Capacity		
MODEL	Size of Cylinders	
	Diameter *	Length *
SCFS	8-1/4" or 210mm	29" or 736mm
SSCFS	9-1/2" or 240mm	31" or 787mm
* - Dimensions include cylinder boot and valve		

4. Layout and function



fig. 4.2-1 Overall View

4.2 Layout

- 1. - Hinged Top Maintenance Panel.
- 2. - Air Management Panel - 4 Bank / Single Regulator Panel is shown.
- 3. - SCBA / SCUBA Fill Cells.
- 4. - Containment Shield Box Drawer.
- 5. - Drawer Latch.
- 6. - Drawer Latch Handle.

4. Layout and function

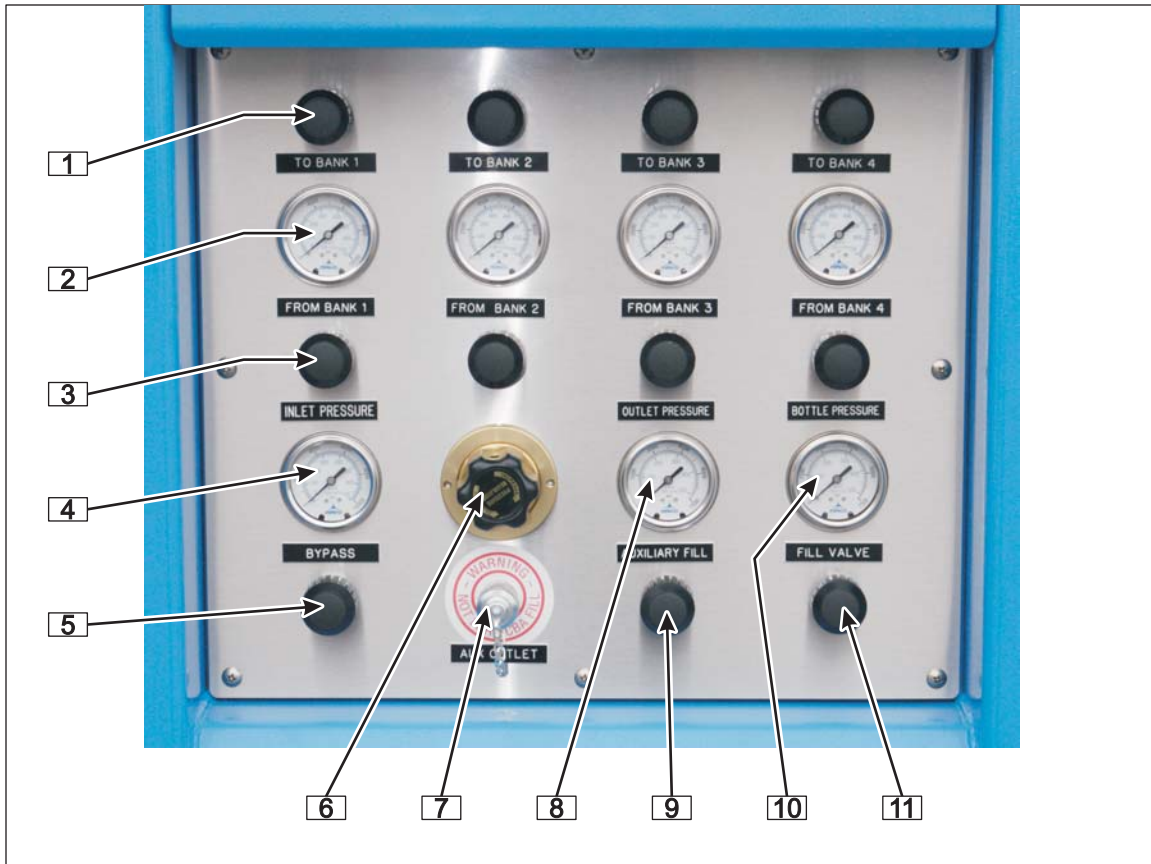


fig. 4.3-1 Overall View

4.3 Panel Layout

1. - * To Bank - These valves control the flow between the compressor and the individual Banks.

2. - * Bank Pressure - These gauges will give you the pressure in each individual Bank.

3. - * From Bank - These valves control the flow between the individual banks and the Regulator(#6).

* - Cascade fill panels may be setup for from 2 to 6 Banks depending on the size of the unit and the options purchased.

4. - Inlet Pressure - This Gauge will read the pressure at the inlet of the Regulator(#6).

5. - Bypass - This valve can Bypass all storage and connect the inlet of the Regulator(#6) directly to the compressor.

6. - Regulator - This device can be set to reduce the storage or compressor pressure to the proper fill pressure.

7. - Auxiliary Outlet - This connection will allow this unit to be connected to a secondary fill station or be used to fill other storage or as a air sample test port.

8. - Outlet Pressure - This Gauge will read the pressure at the outlet of the Regulator(#6).

9. - Auxiliary Fill - This valve can control the flow of air to the Auxiliary Outlet connection.

10. - Bottle Pressure - This Gauge will read the pressure going to the bottle(s) in the Containment Shield Box Drawer(see section 4.2 - #4).

11. - Fill Valve - This Valve will control the flow of air going to the bottle(s) in the Containment Shield Box Drawer(see section 4.2 - #4).

5. Transportation and installation

5.1 Transport

Important!

Care should be exercised when removing the unit from its shipping carton to avoid any damage.

Danger!

This unit must be lifted using suitable forklift truck, which complies with all local safety regulations. See section 4.1 for the weight of this unit.

Before lifting, all loose parts of the unit must be firmly secured.

It is strictly prohibited to work or stand in the danger zone of a lifted load.

Important!

When lifting this unit the forks should be placed so as to lift by the bottom of the frame only. Care should be taken not to hit, pinch or lift by any components or wires that may extend below the frame.



fig. 5.1-1 Lift point markers

Forks must be placed between lift point markers. (See Fig. 5.1-1)

When placing the forks to lift this unit the separation of the forks and their length must be taken into consideration.

Do not slide this unit when it is standing on the floor.

5.2 Machine Location

This unit requires the following environment, services and clearances:

1. - The unit should be located on a level surface capable of supporting its weight.
2. - The unit should be in a relatively clean, debris free, dry shelter out of the elements with an ambient temperature between - 25°C and +55°C (-13°F and 131°F).
3. - Access to a sufficient source of clean compressed air.
4. - An appropriate power supply.(if needed)
5. - We recommend a minimum clearance of 4 ft (1.22 m) in front of the unit, 1 ft (305 mm) on all other sides and a minimum of 26in. (660 mm) above the unit. Contact your local factory service representative for minimum service clearances specific to your location and unit.

Danger !

High pressure air supply lines should be run to minimize the possibility of damage.

Wherever necessary, lines should be protected with structural steel.

5.3 Power Supply

MAKO units are completely wired. It is, however, necessary to have a locally licensed qualified electrician install the appropriate power supply in accordance with local codes if not already available.

6. Operating Instructions

6.1 Standard Fill Procedure

Danger!

Please read your owner's manual carefully for important safety information.

Danger!

Inspect unit and check your logs before beginning to use the unit.
(see section 3.9 and 3.9.1)

Danger!

Fill pressures and fill rates must be in accordance with all local laws, regulations and the bottle manufacturers recommendations.

Danger!

During the operation of this unit if for any reason it is believed that contaminated air has passed into the system or if any leaks or other operational problems are found take the unit out of service record the problem in the Daily log (see section 3.9 and 3.9.1) and report the problem to the appropriate personnel.

Danger!

All access panels must be in place and all guards and safety devices are operating properly before any filling is begun.

Choose the air source to fill from.

- To fill from the compressor and not use storage continue to section 6.1.1.
- To begin filling from storage go to section 6.1.2.

6.1.1 Filling From Compressor

1. - Make sure all valves on fill panel and in containment drawer are closed.
2. - Check that the visual inspections and hydro test of the bottle to be filled are current. Check the bottle to be filled for it's correct pressure rating.
3. - Open bypass valve(see section 4.3 #5) and turn on compressor. The compressor will shut down when the air pressure set point is reached and will restart automatically when pressure drops. Wait for compressor to reach full pressure.

4. - Check that the regulator outlet pressure (see section 4.3 #8) matches the pressure rating of the bottle.

Danger!

All bottles being filled together must have the same pressure rating and filled at the lowest recommended fill rate.

5. - Open fill station containment shield box drawer.(see section 4.2 #4)
 6. - Load customer supplied bottles into the bottle cells(see section 4.2 #3) and connect fill hoses.
 7. - Open valves on customer supplied bottles and fill hose valves that are being used.
- #### **Important!**
- For any fill hoses that are not being used the fill hose valve must be closed.
8. - Close fill station containment shield box drawer.(see section 4.2 #4)
 9. - Open fill valve in accordance with bottle manufacturer's instructions. Typically filling is a slow process.
 10. - Shut off fill valve when bottle pressure and regulator outlet pressure equalize.
 11. - Open fill station containment shield box drawer.(see section 4.2 #4)
 12. - Close valves on customer supplied bottles and fill hose valves.
 13. - Open bleed valves on any air hoses in use.
 14. - Disconnect fill hoses from bottles.
 15. - Remove bottles.
 16. - Close all bleed valves.
 17. - Repeat Steps 2 through 16 until all bottles are filled.
 18. - Close bypass valve(see section 4.3 #5) and Turn off compressor.

6. Operating Instructions

6.1.2 Cascade Filling From Storage

Cascade filling procedure will allow the user to fill more bottles from the system storage banks before he must rely on the fill rate of the compressor. This example is written for a four bank storage system and assumes that all four banks are full.

Begin the filling procedure from section 6.1.

Note.

Never open both To Bank and From Bank valves(see section 4.3 #1 & #2) of the same bank while refilling a bank and cascading off of another bank.

Note.

As Banks are depleted (less than 1000psi.) they should be removed from the cascade rotation. (i.e. when Bank #1 drops below 1000psi. start the next filling cycle with Bank #2)

Note.

As Banks are removed from the cascade rotation they can be refilled one at a time by turning on the compressor and opening the correct To Bank valve(see section 4.3 #1) while more bottles are being filled with the air already in storage.

1. - Make sure all valves on fill panel and in containment drawer are closed.

2. - Check that the visual inspections and hydro test of the bottle to be filled are current. Check the bottle to be filled for it's correct pressure rating.

3. - Open From Bank #1 valve.(see section 4.3 #3) The inlet pressure gauge(see section 4.3 #4) will immediately read the same pressure as the bank #1 pressure gauge.(see section 4.3 #2)

4. - Check that the regulator outlet pressure (see section 4.3 #8) matches the pressure rating of the bottle.

Danger!

All bottles being filled together must have the same pressure rating and filled at the lowest recommended fill rate.

5. - Open fill station containment shield box drawer.(see section 4.2 #4)

6. - Load customer supplied bottles into the bottle cells(see section 4.2 #3) and connect fill hoses.

7. - Open valves on customer supplied bottles and fill hose valves that are being used.

Important!

For any fill hoses that are not being used the fill hose valve must be closed.

8. - Close fill station containment shield box drawer.(see section 4.2 #4)

9. - Open fill valve in accordance with bottle manufacturer's instructions. Typically filling is a slow process.

10. - Close fill valve(see section 4.3 #11) when bottle pressure(see section 4.3 #10) and regulator outlet pressure(see section 4.3 #8) equalize at desired pressure and continue to step #11.

or

If pressures equalize and desired pressure is not obtained continue to step#19

11. - Open fill station containment shield box drawer.(see section 4.2 #4)

12. - Close valves on customer supplied bottles and fill hose valves.

13. - Open bleed valves on any air hoses in use.

14. - Disconnect fill hoses from bottles.

15. - Remove bottles.

16. - Close all bleed valves.

17. - Repeat process beginning at Steps 1 until all bottles are filled.

18. - Continue to step #40

19. - Close "From Bank #1" valve.(see section 4.3 #3)

20. - Open "From Bank #2" valve.(see section 4.3 #3)

6. Operating Instructions

21. - Close fill valve(see section 4.3 #11) when bottle pressure(see section 4.3 #10) and regulator outlet pressure(see section 4.3 #8) equalize at desired pressure and continue to step #22.

or

If pressures equalize and desired pressure is not obtained continue to step#24

22. - Remove filled bottles per steps #11 thru #16 and repeat process beginning at Steps 1 until all bottles are filled.

23. - Continue to step #40

24. - Close "From Bank #2" valve.(see section 4.3 #3)

25. - Open "From Bank #3" valve.(see section 4.3 #3)

26. - Close fill valve(see section 4.3 #11) when bottle pressure(see section 4.3 #10) and regulator outlet pressure(see section 4.3 #8) equalize at desired pressure and continue to step #27.

or

If pressures equalize and desired pressure is not obtained continue to step#29

27. - Remove filled bottles per steps #11 thru #16 and Repeat process beginning at Steps 1 until all bottles are filled.

28. - Continue to step #40

29. - Close "From Bank #3" valve.(see section 4.3 #3)

30. - Open "From Bank #4" valve.(see section 4.3 #3)

31. - Close fill valve(see section 4.3 #11) when bottle pressure(see section 4.3 #10) and regulator outlet pressure(see section 4.3 #8) equalize at desired pressure and continue to step #32.

or

If pressures equalize and desired pressure is not obtained continue to step#34

32. - Remove filled bottles per steps #11 thru #16 and Repeat process beginning at Steps 1 until all bottles are filled.

33. - Continue to step #40

34. - Close "From Bank #4" valve.(see section 4.3 #3)

35. - Start up compressor if it is not already started and open Bypass valve

36. - Close fill valve(see section 4.3 #11) when bottle pressure(see section 4.3 #10) and regulator outlet pressure(see section 4.3 #8) equalize at desired pressure.

37. - Remove filled bottles per steps #11 thru #16 and Repeat process beginning at Steps 1 until all bottles are filled.

38. - Continue filling bottles from stored air and topping-off directly from the compressor until all Banks are depleted.

39. - Continue filling empty tanks from compressor when all Banks are depleted Per 6.1.1 Filling From Compressor .

40. - When all tanks are filled and removed from unit make sure all valves on fill panel and in containment drawer are closed.

41. - Open all To Bank valves(see section 4.3 #3) to any Banks which need to be filled and start up compressor if it is not already started

42. - Close all To Bank valve(see section 4.3 #3) when compressor reaches it's set-point and all banks are at full pressure.

43. - Shutdown Compressor.

44. - Record any pertinent information in your daily log and record the time out.

Note.

These procedures can be varied to suite the status of the system and the operators preferences but safety procedures must never be compromised.

Note.

This procedure is an example of how to run a cascade fill cycle with all banks full. when all Banks are not full. The cascade fill cycle should run starting from the Bank with the lowest pressure, which is over 1000psi, in order of pressure to the bank with the highest pressure.

6. Operating Instructions

6.2 Automatic Flow Regulator

Description

The Automatic Flow Regulator (AFR) controls the flow of air to air cylinders at a prescribed flow rate. Laws and regulations may limit the pressure increase per minute to ensure the cylinders are safely filled without them overheating. These laws and regulations may differ from country to country and the program can be changed accordingly.

Units with the AFR system will not have a Fill Valve(see section 4.3 #11) rather they will have a Green "SYSTEM READY" light, a Red "FILLING IN PROGRESS" light and a green Illuminated "START / STOP FILL CYCLE" button as illustrated in fig. 6.2-1.

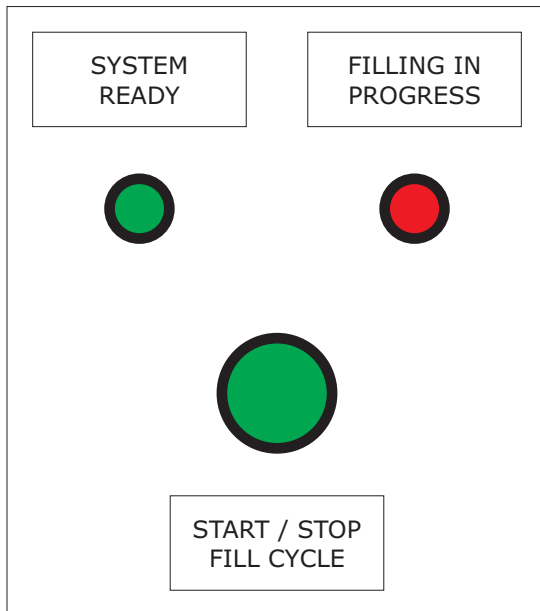


fig. 6.2-1

Operation

Filling procedure for units with the AFR system should follow all the same rules as the standard filling procedures laid down in section 6.1, 6.1.1 and 6.1.2 the changes are as follows.

Danger!

Only open the "Containment Shield Box Drawer"(see section 4.2 #4) when the Green "SYSTEM READY"light is on.(see fig. 6.2-1)

Danger!

The entire filling cycle must be closely observed and the regulator outlet pressure continuously adjusted when the regulator outlet pressure is being set.

After the bottles are checked, loaded and connected check the regulator outlet pressure during the first fill cycle.

When bottles are ready to fill and the green "SYSTEM READY" (see fig. 6.2-1) light is on rather than opening the "Fill Valve" see section 4.3 #11 on any regular fill panel. press the "START / STOP FILL CYCLE" button(see fig. 6.2-1) to begin the fill cycle. The green "SYSTEM READY" (see fig. 6.2-1) light will go out and the "START / STOP FILL CYCLE" button(see fig. 6.2-1) will light up.

When the AFR cycle pressure reaches the pressure in the bottle then the Red "FILLING IN PROGRESS" light will light up.(see fig. 6.2-1) and the bottle will begin being filled.

When all bottles being filled are at full pressure press the green Illuminated "START / STOP FILL CYCLE" button.

The Red "FILLING IN PROGRESS" light (see fig. 6.2-1) and the green Illuminated "START / STOP FILL CYCLE" button (see fig. 6.2-1) will go out and the green "SYSTEM READY" (see fig. 6.2-1) light will light up.

Finish filling procedure as laid down in section 6.1, 6.1.1 and 6.1.2 and repeat filling process until all bottles are filled.

Danger!

The AFR system should be serviced by Authorised Service Personnel only.

[illegible]

