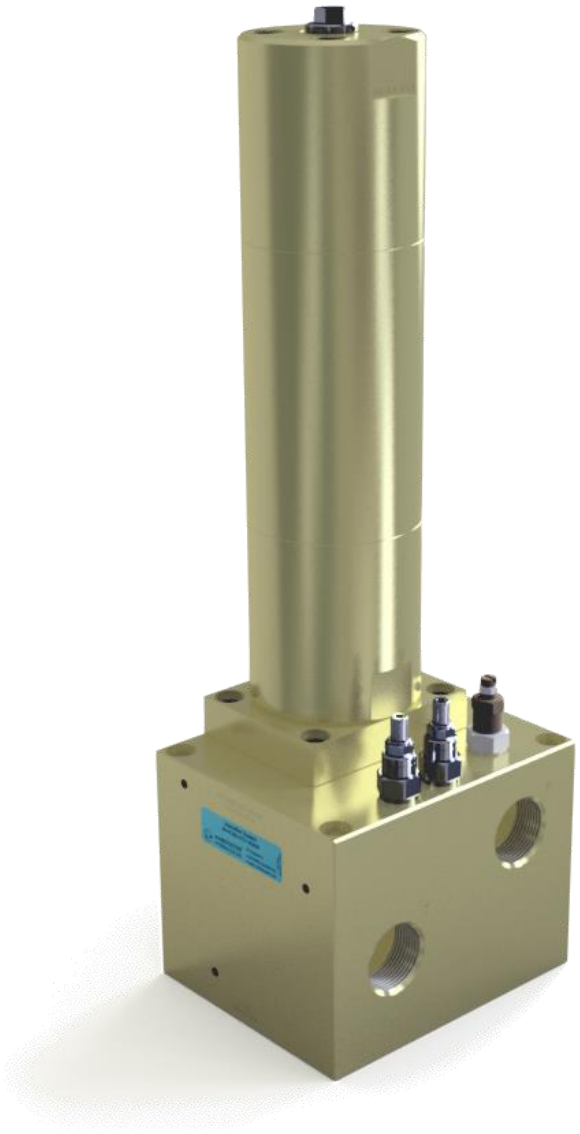


INSTRUCTION MANUAL

Valid for

- M-HC6D-013-1K200
- M-HC6D-013-1K400

1.1 - Safety precautions IMPORTANT

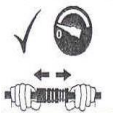
Although the miniBOOSTER hydraulic intensifier system has been designed with operator safety in mind, it still requires the operator to be vigilant upon use.

Therefore it should be observed that the below mentioned safety instructions are obliged to. Contact miniBOOSTER or your local miniBOOSTER distributor in case of any doubt.

Read all instructions, warnings, and cautions carefully. Follow all safety precautions to avoid personal injury or property damage during system operation. miniBOOSTER cannot be held responsible for damage or injury resulting from unsafe use, lack of maintenance or incorrect product and/or system operation. Contact your miniBOOSTER distributor if in doubt as to the safety precautions and operations.

Eye protection must be worn while unpacking, installing, repairing and initial start-up of this miniBOOSTER product.

Gloves must be worn while unpacking, installing, repairing and initial start-up of this miniBOOSTER product.



The hydraulic system should always be de-pressurized before any couplings are disconnected. Check the integrity of connections before applying any hydraulic pressure.

Do not apply any hydraulic pressure to non-connected fittings.

Do not unscrew any nipples, couplings or fittings being under any hydraulic pressure.

Do not exceed the maximum working pressure of the hydraulic system.

Avoid sharp bends and kinks when routing hydraulic hoses.

Never exceed the maximum working pressure of the hydraulic system.
If the hydraulic system is under pressure **DO NOT STAND IN LINE** with any fittings, connections or moving parts ie. piston-rods and/or any other parts mechanically or hydraulically connected to the hydraulic system

All hoses, couplings and fittings connected to the hydraulic system i.e. including the miniBOOSTER, must be kept clean and free from debris and contamination at all times. Follow all instructions given in this manual whenever installing, running and/or repairing the miniBOOSTER M-HC_-013- 1K200/400.

This instruction does not supersede any local safety regulations or relevant hazardous, regulations, which must always take precedence.

Do never exceed the specified maximum pressure ranges, temperatures and flows.

Do never put the component into operation until the machine it is assembled into is complying with all relevant Directives and regulations in EU and EFTA.

miniBOOSTER® A/S cannot be held responsible for damage or injury resulting from unsafe use of the product, lack of maintenance, or incorrect product and system application.

Contact your local distributor, the manufacturer or visit www.minibooster.com if in any doubt as to safety precautions or applications.

1.2 - Warranty

Never attempt to disassemble the booster or any other component from the system where it is not specifically described to do so. Any attempt will void the warranty if no consulting has taken place with miniBOOSTER.

DECLARATION OF CONFORMITY

We the manufacturer:

miniBOOSTER Hydraulics A/S
Fynsgade 3
DK 6400 Sønderborg
DENMARK

Declare that:

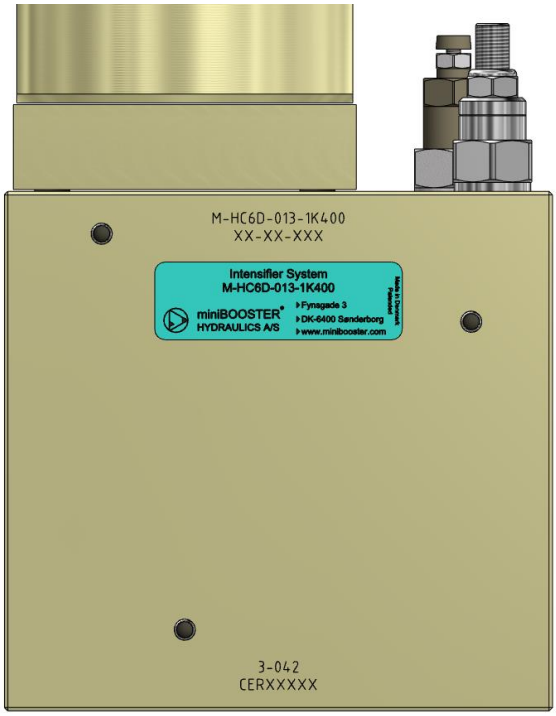
Hydraulic Intensifiers all types, variants and accessories, are designed and manufactured in accordance to the below Directives

2006/42/EC Machinery Safety Directive
97/93/EC Pressure Equipment Directive where required (Max HPXVol >10.000)

The manufacturer miniBOOSTER® is ISO 9001 certified by Bureau Veritas (Certificate number DNKFRC10000046A). Each hydraulic intensifier has an identifiable serial number, stamped into its metal-body. Year of manufacture and intensification factor is stamped into the metal body too. All technical documentation is drafted in accordance to the term “sound engineering practice”, and in accordance to all of the processes and test-procedures described in miniBOOSTER´s process-guides. All intensifiers are individually pressure tested prior to the EOL-approval.

1.3 - Serial number & identification plate location

Each individual pressure intensifier system can be identified by a unique serial number and its type-code which is stamped on the manifold housing.
The type number and the serial number is required when ordering repairs of the miniBOOSTER pressure intensifier systems.



M-HC6D-013-1K400	Model
XX-XX-XXX	Serial number (week-year-number)
3-042	Manifold number
CERXXXXX	Materials certificate

Nomenclature:

M	Manifold system
HC6D	Booster model
013	Function diagram
1	BSPP threaded connection
K	Pressure up to 500 bar / 7,250 psi
400	400 l/min maximum flow capacity

1.4 - Material Certificate

All body parts of the pressure intensifier system are marked with a 3.1 material certificate specification number, which provides materials traceability.

A material certificate verifies the origin batch numbers, the compositions and the test results of the materials used for the individual body parts. It is possible to order the certificates on request.

1.5 - Technical specification

Model:	**M-HC6D-013-1K200**	**M-HC3-013-1K400**
Weight:	48kg / 106 lbs	48 kg / 106 lbs

Never exceed the below pressure, flow and temperature ranges, as this will damage the internal seals of the intensifier.

Pressure ranges

Inlet	P	0 - 350 bar / 5,076 psi
Outlet	H & M	0 - 500 bar / 7,250 psi
Tank	T & Z	0 - 350 bar / 5,076 psi

Flow ranges (M-HC6D-013-1K200)

Inlet	P	0 - 200 l/min / 53 US gpm
Outlet	H	0 - 200 l/min / 53 US gpm
Tank	T & Z	0 - 200 l/min / 53 US gpm

Flow ranges (M-HC6D-013-1K400)

Inlet	P	0 - 400 l/min / 106 US gpm
Outlet	H	0 - 400 l/min / 106 US gpm
Tank	T & Z	0 - 400 l/min / 106US gpm

Threaded connections

P, T, H, Z	1-1/4” BSPP
M	1/4” BSPP

Temperature ranges

Media oil	-40°C to +100°C / -40°F to +212°F

Stroke ranges

Continuous	> 5 minutes from 1 to maximum 500 strokes/minute
Intermittent	< 5 minutes from 1 to maximum 600 strokes/minute

Materials of construction

Manifold housing	Cast iron
Boosters	Cast iron
Check valves	Alloy steel
Static seals standard	Nitrile NBR

Max. tightening torque

1-1/4” BSPP	200 Nm
¼” BSPP	40 Nm
M10x150 screw	70 Nm

Fluids

Recognized hydraulic fluids.

Filtration recommendations

		0-140 BAR (0-2030 psi)		141-200 BAR (2031-2900 psi)		> 200 BAR (> 2900 psi)	
Media		ISO 4406 Scale number	Micron ratings	ISO 4406 Scale number	Micron ratings	ISO 4406 Scale number	Micron ratings
Oil	> 5 cSt	19/17/14	10	18/16/13	5	17/15/12	3

Medias not filtered in accordance with the recommendations given in this chapter may be the reason to severe damage of the pressure intensifier system.

2.1 - Product description

The M-HC6D-013-1K200/400 pressure intensifier system is designed to increase the pump pressure up to 500 bar / 7,250 psi. The pressure is boosted from the “P” connection of the system to the “H” connection. The system is mountable to the equipment with four (4) provided M10 x 150 screws.

The system has three extended features in comparison to stand-alone boosters:

Automatic Pressure Intensification
(Sequence Valve)

When the backpressure (load on e.g. a cylinder) exceeds the pressure capability of the pump, the Sequence Valve directs the oil to the booster and increases the pressure beyond the pump specification. On the contrary, a high bypass flow to the workload is maintained for the time the Sequence Valve is not activated. The setpoint of the sequence valve is adjustable from 10.5 - 350 bar / 152 - 5,000 psi. In general, it is recommended to adjust the valve to 90% of the pressure the pump can handle.

Example:

A setup consists of a pump which is connected to a 4/3 way directional control valve. The valve connects to the M-HC6D-013-1K200/400 intensifier system which is then connected to a cylinder.
The pump is capable of delivering a maximum pressure of 100 bar. The Sequence Valve is by recommendation set to 90 bar. When the pump pressure reaches 90 bar as a result of an increased load on the cylinder, the valve directs the oil to the booster which now increases the pressure beyond the capability of the pump. In the range of 0-90 bar backpressure, the cylinder is extended at full speed.

Increased inlet pressure
(Pressure Reducing Valve)

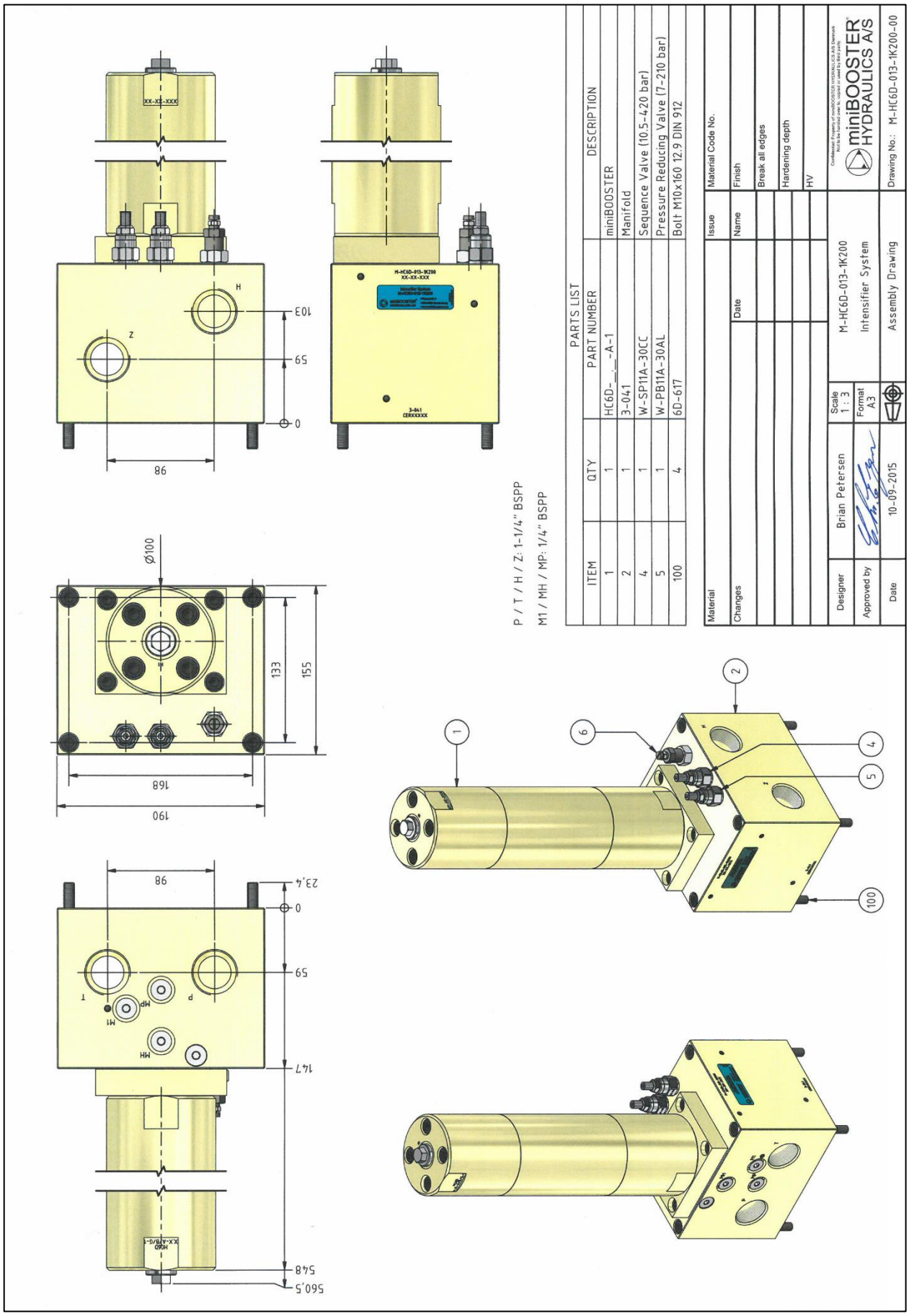
A Pressure Reducing Valve enables the user to control the inlet pressure to the booster. Stand-alone boosters are normally limited to 207 bar / 3,000 psi of inlet pressure, but implementation of the reducing valve extends the allowed pump pressure up to 350 bar / 5,076 psi. It is recommended to keep the setting as low as possible in relation to the needed outlet pressure.
The valve is adjustable from 7 - 210 bar / 102 – 3,046 psi.

Safety Relief Valve
The pressure intensifier system is equipped with a Safety Relief Valve. The valve controls the maximum outlet pressure of the H connection (To the A *or* B port of e.g. a cylinder). The pressure is adjustable up to 500 bar / 7,250 psi.

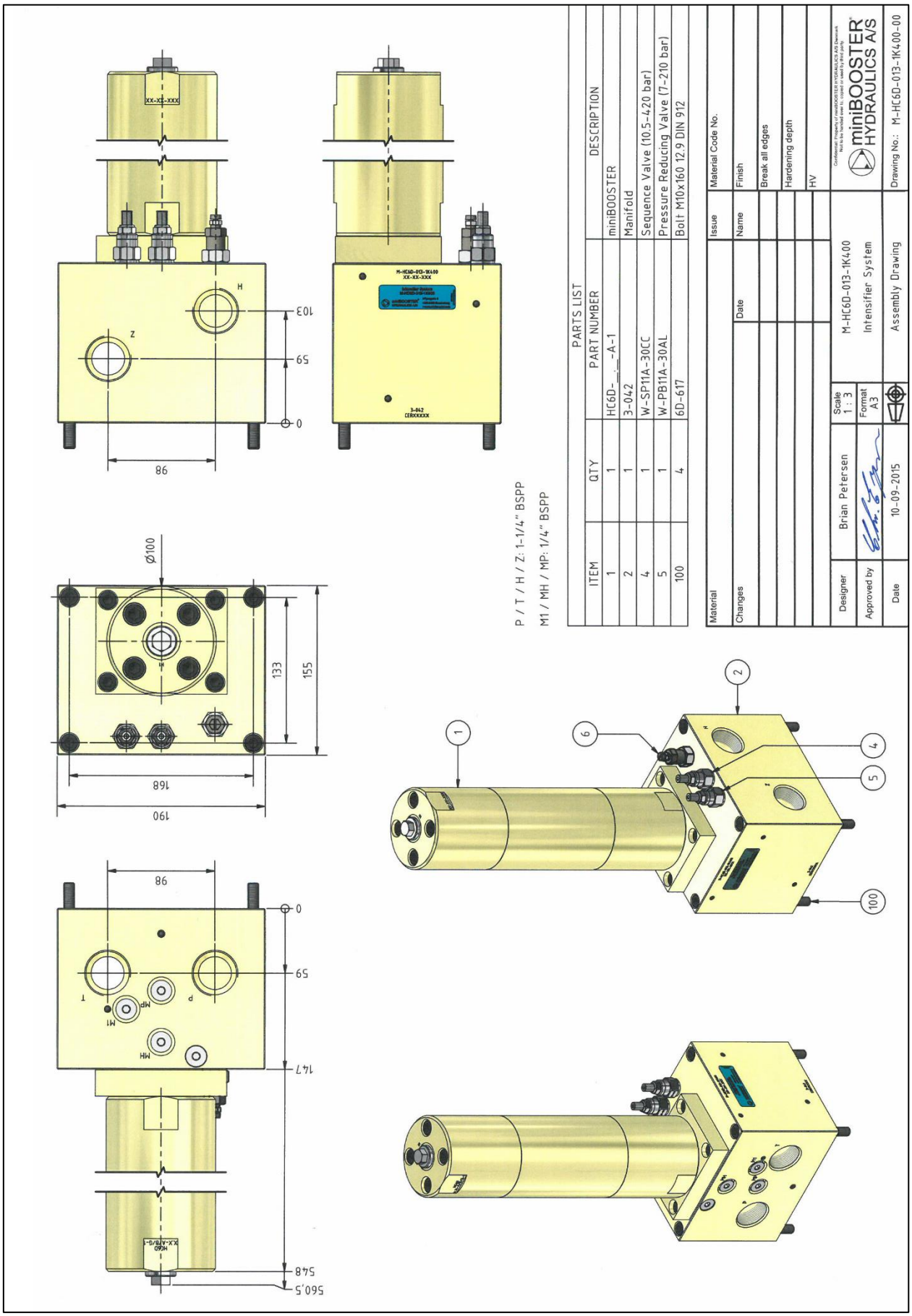
Key features of the pressure intensifier system:

- Adjustable sequence valve to automatically boost pressure and take full advantage of the available pump flow.
- Fine adjustment of outlet pressure and realization of 350 bar inlet pressure.
- Adjustable high pressure Relief Valve.

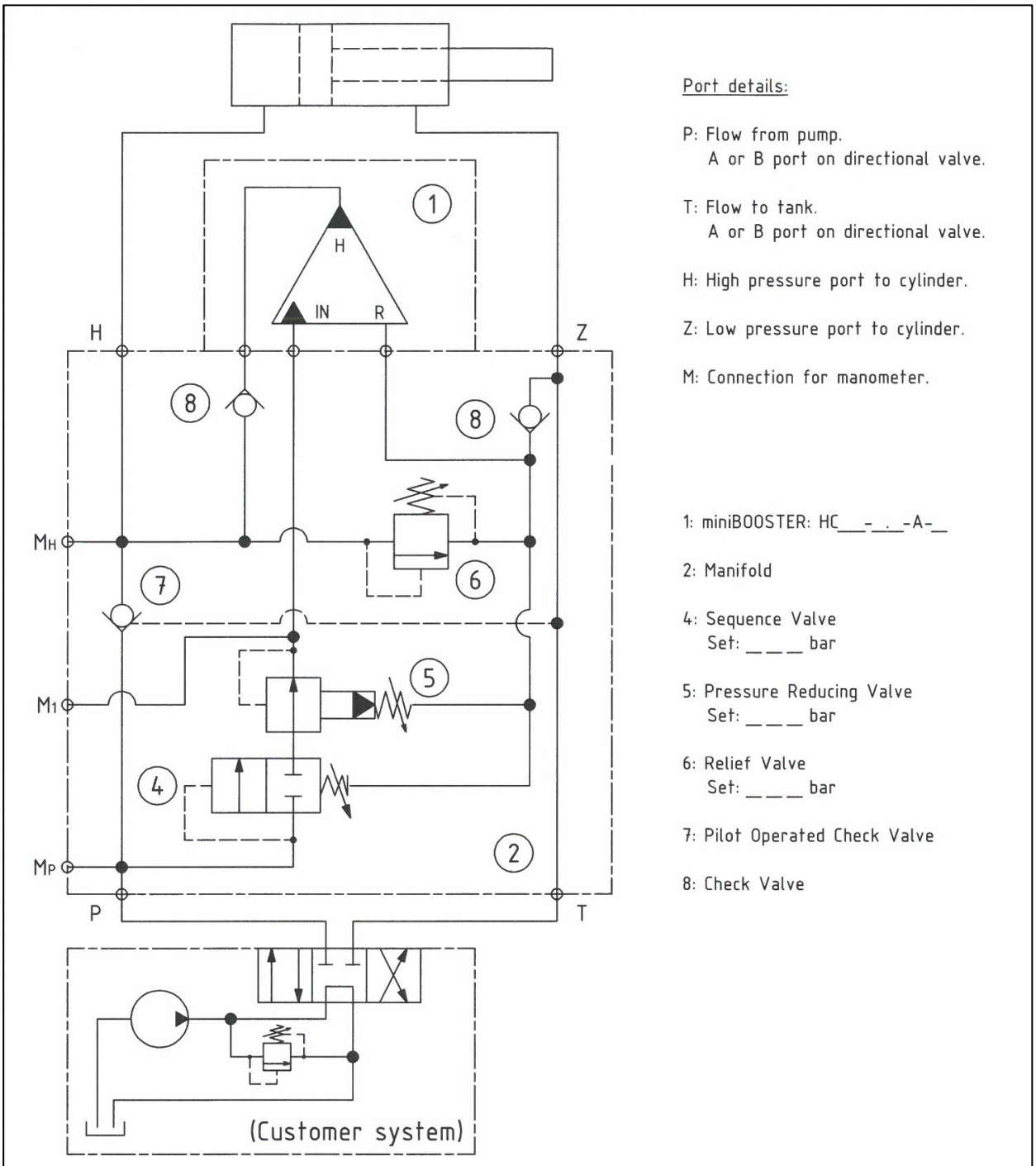
2.2 - M-HC6D-013-1K200 – Assembly drawing



2.3 - M-HC6D-013-1K400 – Assembly drawing



2.4 - Function diagram



Material			Issue	Material Code No.
Changes Manometer ports added: MP & M1. M changed to MH		Date 03-02-2015	Name BP	Finish
				Break all edges
				Hardening depth
				HV
Designer	Brian Petersen	Scale	M-HC_-013	Confidential: Property of miniBOOSTER HYDRAULICS A/S Denmark. Not to be handed over to, copied or used by third party.
Approved by		Format		miniBOOSTER HYDRAULICS A/S
Date	07-02-2014		Function Diagram	Drawing No.: 013-01

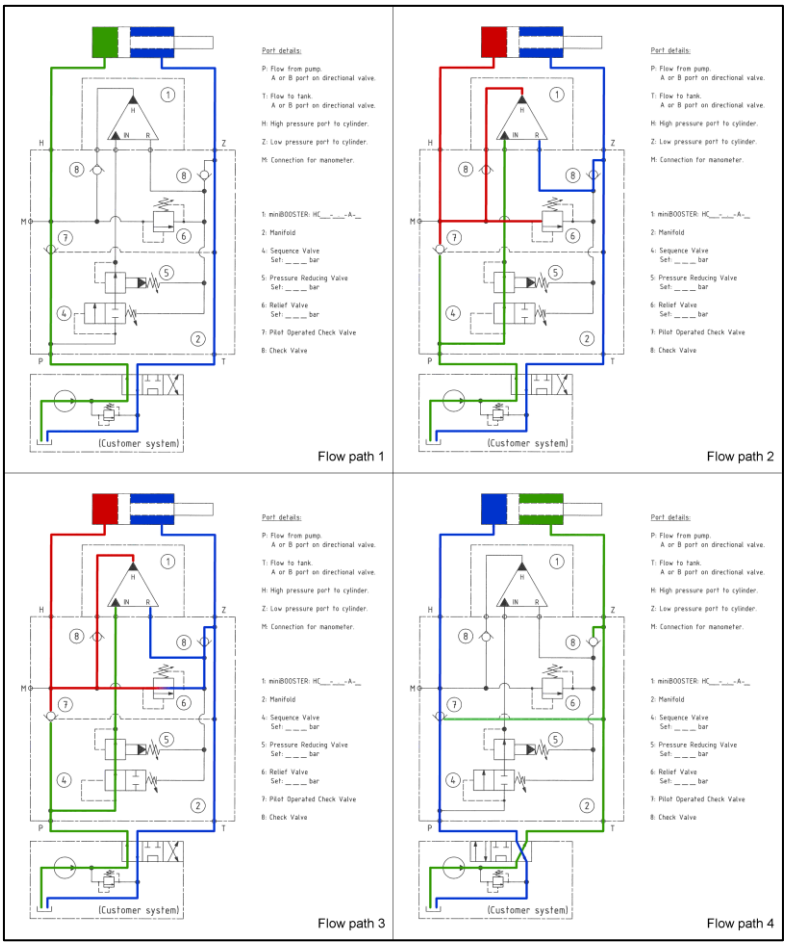
2.5 - Function diagram flow paths

Flow path 1 – System pressure (P to H)
Oil flow from the external system pump enters at the P connection of the manifold. From P the oil is bypassed through the PO check valve (7) where it exits at connection H and flows to the cylinder. Flow is blocked by the Sequence Valve (4), the high pressure Relief Valve (6) and the Check Valve (left 8). Oil from the opposite side of the cylinder enters at connection Z end exits at T where it flows back to the tank.

Flow path 2 – High pressure
When the backpressure from the cylinder has reached the Sequence Valves (4) set point, the oil flow will pass through the valve and be pressure regulated by the Pressure Reducing Valve (5). The regulated oil pressure enters the IN connection of the booster (1) and high pressure oil exits and flows through the check valve (left 8). Finally, the oil leaves at connection H where it flows to the cylinder. Flow is blocked by the PO check valve (7) and the high pressure Relief Valve (6).

Flow path 3 – High pressure relief
When the backpressure from the cylinder has reached the high pressure Relief Valve (6) set point, the flow passes through the valve and flows to the T connection where it exits to tank. The maximum possible pressure has now been reached.

Flow path 4 – System pressure (T to Z)
Oil flow from the external system pump enters at the T connection of the manifold. From T the oil exits at connection Z and flows to the cylinder. The oil on the opposite side of the cylinder is initially blocked by the PO check valve (7), but opens due to a pilot signal from T. Oil flows to P where it exits back to the tank.

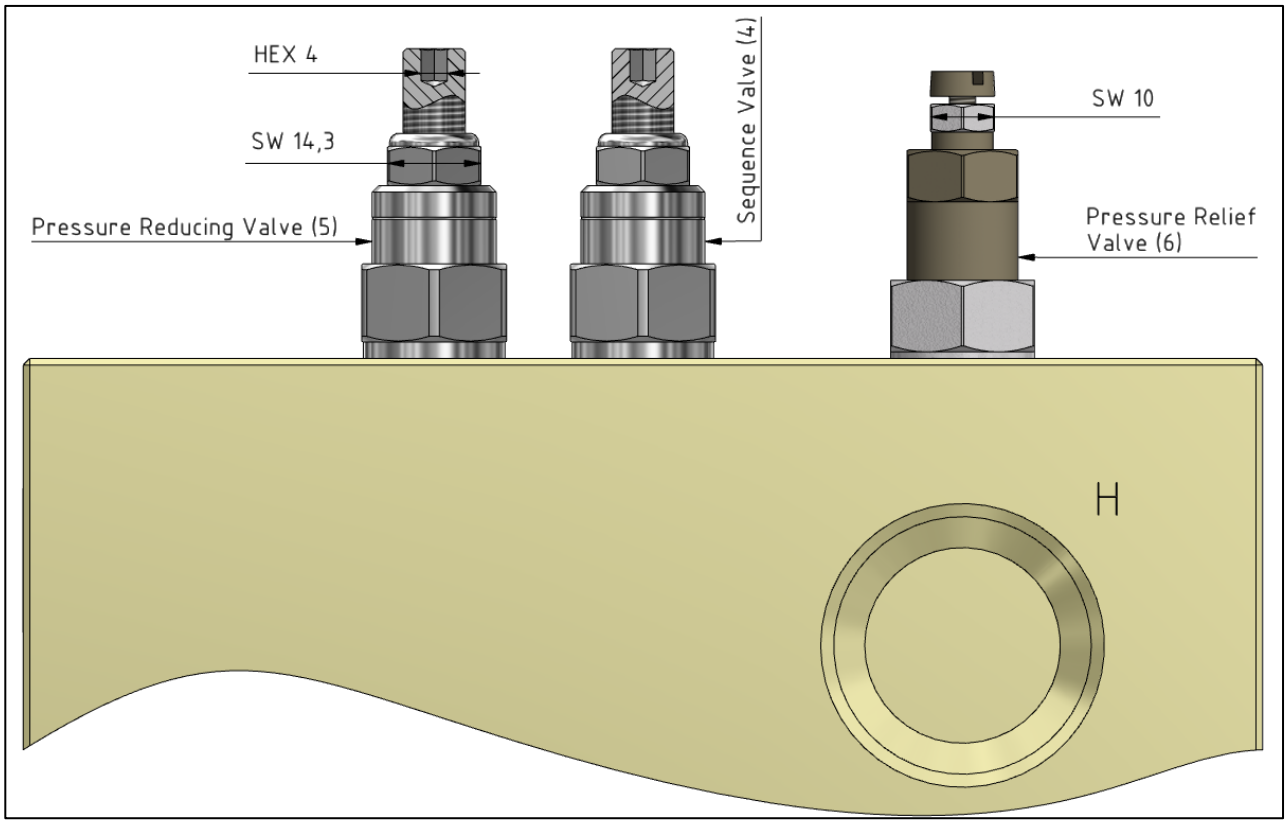


Pump flow

Return flow

HP flow

The Sequence-, Pressure Reducing- and high pressure Relief Valves are all pre-adjusted to customer specific settings. If needed, the following section provides guidance for any needed re-adjustment. A guide to adjust the intensifier system from scratch is also included.



3.1 - Backpressure control (Sequence valve)

Tools required:

4 mm hex key
14.3 mm spanner or adjustable wrench

CW = Clockwise direction
CCW = Counter Clockwise direction

Step 1
Loosen the 14.3 mm nut from the stem of the valve (CCW).

Step 2
Use the 4 mm hex key to rotate the stem and adjust the backpressure setting. (explanation on page 5)

CW = Increase backpressure setting.

ΔP per one turn: 100 bar / 1.450 psi

CCW = Decrease backpressure setting.

Step 3
Retighten the nut (do not use excessive force). Use the 4 mm hex key to prevent the stem from rotating.

3.2 – Booster inlet pressure control (Pressure Reducing Valve)

Tools required:

4 mm hex key
14.3 mm spanner or adjustable wrench

CW = Clockwise direction
CCW = Counter Clockwise direction

Step 1
Loosen the 14.3 mm nut from the stem of the valve (CCW).

Step 2
Use the 4 mm hex key to rotate the stem and adjust the reducing pressure. (explanation on page 5)

CW = Increase inlet pressure to the booster.

ΔP per one turn: 50 bar / 725 psi

CCW = Decrease inlet pressure to the booster.

Step 3

Retighten the nut (do not use excessive force). Use the 4 mm hex key to prevent the stem from rotating.

3.3 - High pressure outlet control (Relief Valve)

Tools required:

10 mm spanner
Screwdriver

CW = Clockwise direction
CCW = Counter Clockwise direction

Step 1
Loosen the 10 mm nut from the stem of the valve (CCW).

Step 2
Use the screwdriver to rotate the stem and adjust the outlet pressure. (explanation on page 5)

CW = Increase outlet pressure of H or Z connection.

ΔP per one turn: 94 bar / 1,363 psi

CCW = Decrease outlet pressure of H or Z connection.

Step 3
Retighten the nut (do not use excessive force). Use the screwdriver to prevent the stem from rotating.

3.4 - Adjustment from scratch

Preliminary steps:

- ✓ Stop the pump.
- ✓ Increase the sequence valve backpressure setting as much as possible (CW).
- ✓ Increase the pressure reducing valve setting as much as possible (CW).
- ✓ Decrease the high pressure Relief Valve setting as much as possible (CCW).

Step 1

First, we will establish an even inlet pressure that serves as a setpoint for adjusting the backpressure. To be able to do so, we need to use the high pressure Relief Valve.

Start the pump and increase the high pressure Relief Valve setting (CW), until the desired backpressure setting is reached by reading off the pressure from the system pump manometer. The reading may also be taken from the MP connection on the intensifier system manifold.

Finally, decrease the Sequence Valve backpressure setting until the booster starts to oscillate (CCW). Use your hand and hearing to sense the oscillation. When the oscillating starts, the Sequence Valve has just crossed the setpoint that was made previous.

The backpressure setting is now ok.

Step 2

Increase the high pressure Relief Valve setting to the desired maximum allowable outlet pressure (CW). The reading may be taken from either the H or MH outlet on the intensifier system manifold.

The high pressure Relief Valve setting is now ok.

Step 3

Decrease the Pressure Reducing Valve setting (CW), until the desired inlet pressure to the booster is made. The pressure can be read from the M1 connection of the intensifier system. It is recommended to adjust the pressure to a setting that is just sufficient for the booster to be able to reach the desired maximum pressure.

4.1 - General use

All new or repaired intensifiers from miniBOOSTER have been hydraulically tested under full load conditions after assembly and are guaranteed full functionality and efficiency.

The pressure intensifier systems has been designed and manufactured to provide reliable service over a range of demanding applications. The intensifier does not require special maintenance, but should be kept free from dust, dirt and debris.

A visual inspection for oil escaping on any exterior part of the pressure intensifier system should be conducted on a regular basis.

4.2 - Installation

The pressure intensifier system could be installed in any position (vertical, horizontal, angled etc.) Use the four provided screws to firmly secure the system.

Either way the pressure intensifier system is installed, it is important that the system is initially started-up in accordance to the below mentioned instructions. Incorrect initial start-up of the intensifier may cause severe damages to the internal components of the intensifier.

4.3 - Bleeding and initial starting-up

At the initial start-up the intensifier should be operated gently at a max LP-IN pressure of approximately 100 bar (1,450 psi) for 5 to 10 minutes, as to ensure it is properly bled from trapped air. Hereafter the pressure intensifier system could be operated at its full capacity.

IMPORTANT! At no time should the intensifier be operated beyond the specifications listed in Section 1.5

4.4 - Repair

In case the intensifier should malfunction, all repairs of the product should be conducted by miniBOOSTER only i.e. since any intervention on the intensifier requires special tools and special testing equipment.

Before the pressure intensifier system is disconnected and sent for repair, it should be thoroughly cleaned at the exterior. Once the pressure intensifier system has been disconnected all connection bores should immediately be plugged efficiently with plugs or tape, before the intensifier is sent to miniBOOSTER or to the miniBOOSTER distributor, i.e. since an internal contamination of the intensifier may obstruct the fault-finding process at the miniBOOSTER service department.

Symptom	Possible causes	Remedy
High pressure does not reach 500 bar / 7,250 psi	Pump pressure, PRV or HP relief valve	Increase the pump pressure to at least 140 bar / 2030 psi. Adjust the HP relief valve setting (See section 3.2)
High pressure is not building up. Booster does not oscillate when the cylinder has been filled.	Sequence valve	Adjust the sequence valve setting (See section 3.1)
None of the above symptoms		Consult miniBOOSTER

Authorized distributor:

miniBOOSTER®
HYDRAULICS A/S

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DK-6400 Sønderborg
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