Hydrokompenser Option for SBS Balancer Control

L-4300-2

OPERATION AND SPECIFICATION MANUAL ADDENDUM

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Operation and Specification Addendum for the SBS Hydrokompenser Option

Manual addendum for use with the
SBS Balance System Operation Manual (Document L-4100-x)

Part# L-4300-2

Revision # 2.0

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Product Overview

This manual addendum describes the installation and use of SBS Hydrokompenser fluid balancers. Only issues particular to the Hydrokompenser system are discussed, including System configuration and installation. Operation of SBS Hydrokompenser balancers is similar to mechanical balancers, and the user is directed to refer to the SBS Balance System Operation and Specification Manual (L-4100-1) for complete details on system operation.

System Configuration

The balancing system consists of:

- **The SB-4500 Series measuring and control unit**
- **A piezoelectric vibration sensor with integrated charge amplifier**
- **An annular container (the "balancing chamber" for the liquid correction medium)**
- **An injection system (the "Nozzle Block")**
- **A valve block with integrated coolant conditioning unit**

All components of the balancing system are microprocessor-controlled. Should performance fail, the diagnostic system will signal the cause. Important machine parameters such as balance tolerance, balance quality, smooth running of the grinder and speed are available through the information system. Control of the balancing operation is either manual or automatic via the machine controller. Figure 1 explains the basic operation of the Hydrokompenser system using four quadrants inside the balancing chamber. The reference numbers in the following text refer to Figure 2 showing a schematic system overview.

Compensation of grinding wheel unbalance (U) is by means of liquid media (coolant or oil). The liquid medium is injected into the annular container (8), which is secured to the rotating grinding wheel flange (1). The compensation weight (K) is subdivided into two vectors (V1 + V2).

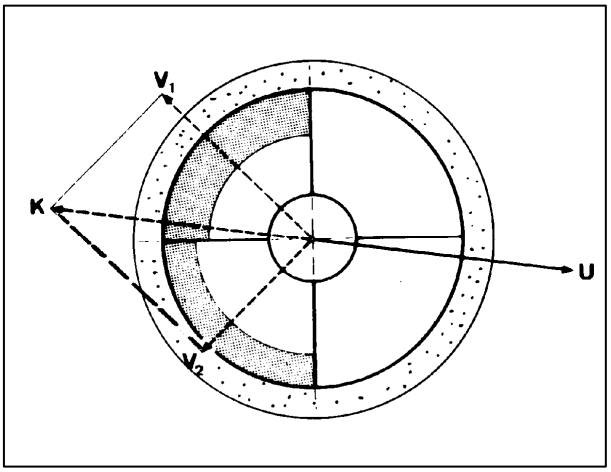


Fig.1 Vector diagram of unbalance (U), compensation weight (K) and Vectors V1 and V2 of fluid in chambers

A vibration transducer (3) is fitted on the headstock for determination of the amount of unbalance, while the speed sensor usually built into the nozzle block (4) detects the position of unbalance. (External speed sensors are also available.) The correction weight is determined by the electronic measuring and control unit (5) to control mass correction (V1 + V2) accordingly. Hence the individual valves in the valve block (7) open as commanded by the control unit and the liquid medium (machine coolant 6) is led to the corresponding nozzle in the nozzle block (4). The nozzles inject the coolant into one or two quadrants in the ring chamber (8) as a continuous stream. The annular grooves collect the liquid and insure most of it enters the required quadrant.

The SBS Hydrokompenser controller unit is essentially the same as the SB-4500 controller for mechanical systems. To differentiate the systems, it carries a –H suffix on the part number. An acoustical emission card (AEMS) together with the corresponding sensor can be added to the controller if required. The AEMS sensor is a high frequency acoustical sensor, designed for use with the SBS AEMS product. This

product can be ordered separately and enables the user to monitor the grinding process on the machine, providing Gap Elimination, Crash protection, and dressing and grinding monitoring.

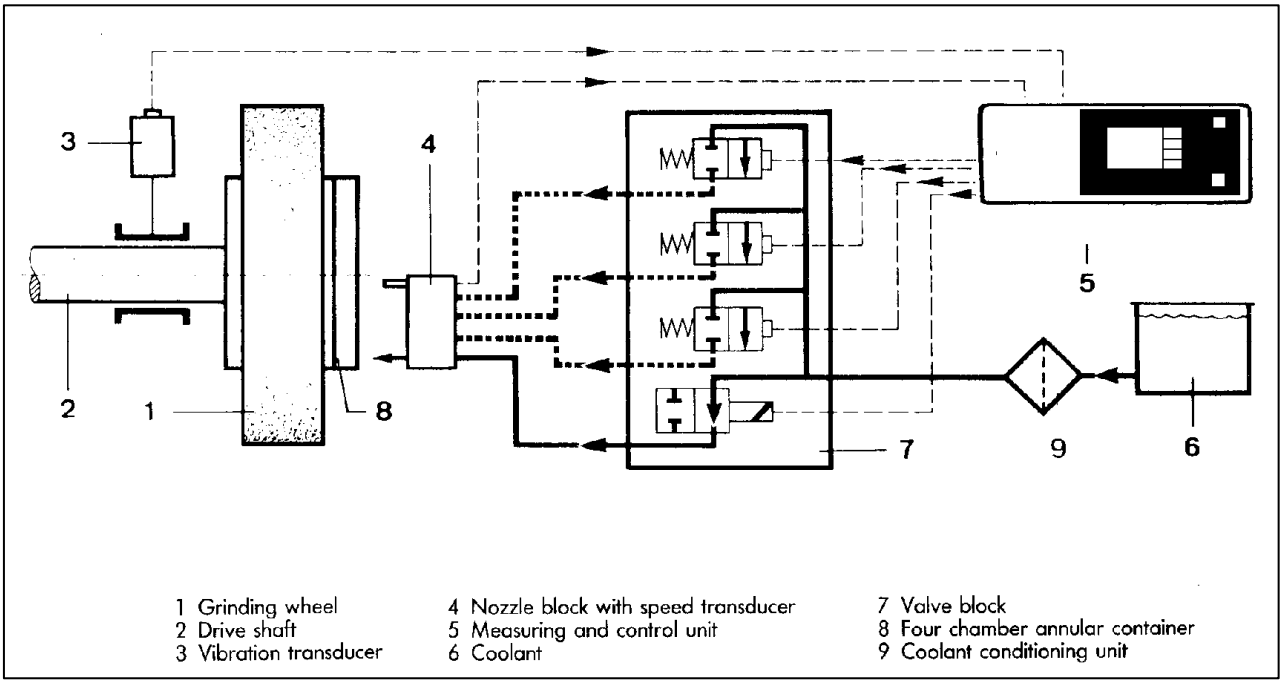
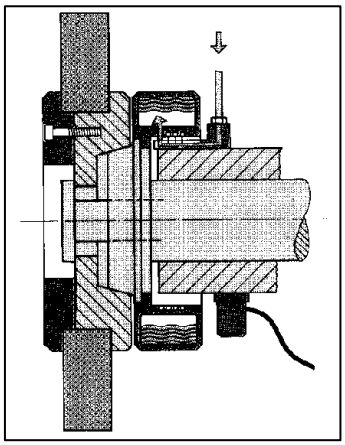


Fig 2. Schematic diagram of SB-4500-H Hydrokompenser System

The Hydrokompenser System allows for a great variety of implementation, and supports machine operation at machine speeds up to 15,000 rpm in certain applications, which makes it the perfect solution for solving unbalance problems on machine types that mechanical balancers can't address. Individual Hydrokompenser Chambers are designed for individual applications, with specific maximum spindle rotational speeds for each design. **Caution: Exceeding the maximum spindle speed reported to Schmitt Industries, Inc. during application engineering, may result in dangerous part failure.**

A chamber can be designed for any application, and can be bolted to the grinder (Fig. 3), or be built into the machine for OEM applications (Fig. 4). This manual addendum can therefore not possibly cover all methods of attachment of chambers to machines. However, they all have in common a simple installation by several bolts and a pilot bore for precise alignment.

Fig 3



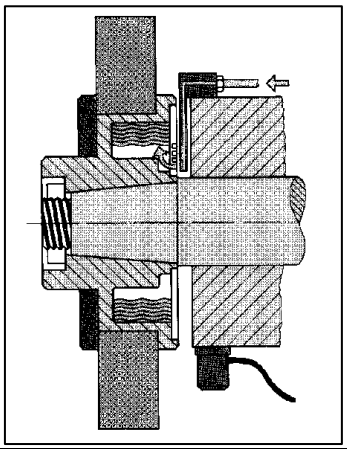


Fig. 4

System Installation

System Connections

To operate the SBS Hydrokompenser, it is necessary to have a Hydrokompenser version Balance Control Card installed in your SBS Control Unit. If your control unit model is designated with a –H suffix, then this type of control card was shipped with your unit. The required card (P/N SB-4518) can also be ordered separately and installed into any SBS 4500 series control. To add cards to the SBS control unit, follow the Balancer Card installation instructions in the SBS System Operation Manual.

In one of the numbered slots on the rear of the control unit, locate the Hydrokompenser you wish to connect to. This card will look like the picture at right, with the top connector having twelve pins. Use the supplied SB-46xx series cable to connect the Valve Block to the Control unit. Vibration Sensor installation and location is covered in depth in the system Operation Manual. Care must be taken to locate the Sensor properly on the machine.

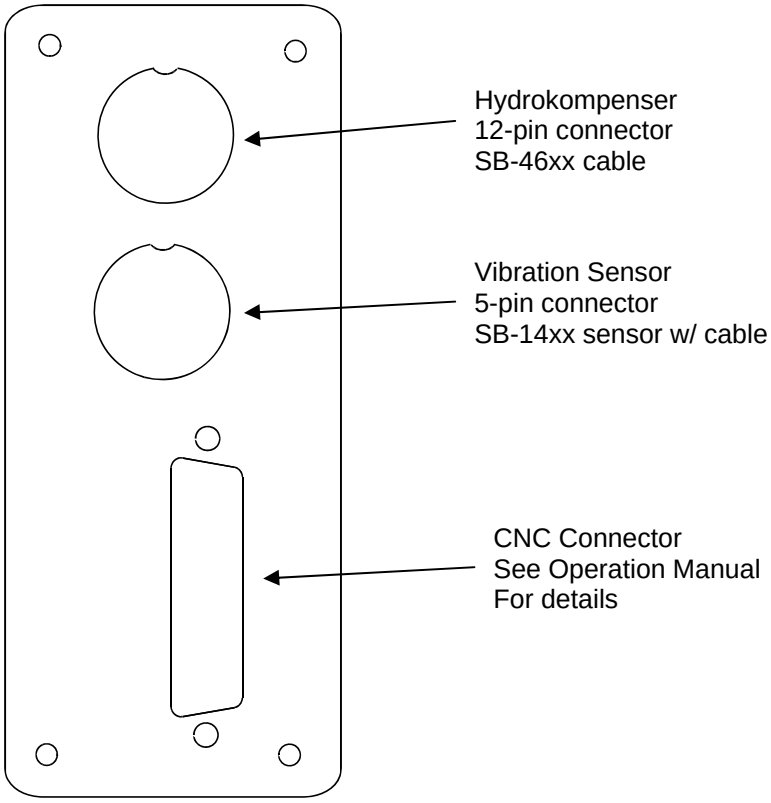


Fig. 5

Refer to the overview drawing in Appendix A for a better understanding of the necessary cable connections and all possible cable lengths and variations.

Valve Block Installation

Other than cable connections, the other issue particular the Hydrokompenser Balancers is the installation of the Valve Block in a clean part of the machine as close as possible to the nozzle block. Typically, the valve block is mounted at a distance of 1,5 meters (5 feet). This corresponds to the standard length of hose attached to the nozzle blocks. The mounting dimensions for the valve block can be found in Appendix B.

Nozzle Block Installation and Alignment

This separate unit must be mounted to a stationary part of the machine, located so that the outer face of the cylindrical portion of the "round" nozzle block, or the nozzle tip of the "L-shaped" flat nozzle block is facing directly opposite the Chambers on the Balancer. The alignment of the nozzles is critical, as it determines the speed and accuracy of the balancing process. For proper operation, the nozzles must be located within a maximum distance from the Chamber face of 1-3 mm.

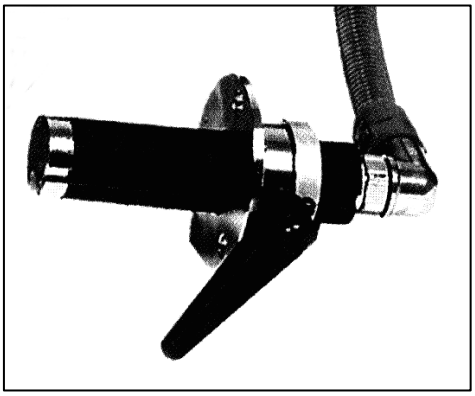


Fig. 6 Round Nozzle Block with standard mounting bracket and hose attached

Attachment to the machine is best accomplished by a simple bracket of proper dimension to hold the Nozzle Block in the required position during machine operation. Where necessary, the ability to make finish adjustments in distance and alignment of the Sender should be provided for in the bracket design. Because the requirements for mounting are dependent on individual machine design, machine use, and customer preference, the customer should provide the required bracket for attachment of the Sender. SBS will provide design and fabrication services for customers who so desire.

Once the nozzle block is hooked up properly to the valve block, set the pressure using the pressure regulator on the valve block. Adjust the coolant jet exiting the nozzles in a way that it is deflected after 1 ½ ft. (0.5 m). If a water-based coolant is used, this should correspond to a pressure of 7 - 21 psi (0.5-1.5 bars), depending on the distance between valve block and nozzle block. If oil is used, this should correspond to a pressure of 14 – 58 psi (1-4 bars).

Calibrating the Speed Sensor

The speed sensor can be automatically calibrated the first time the unit is operated. After installation of all system components and cables, switch on the controller and wait for it to display the main menu. Do not switch on the spindle. Loosen the mounting bolts and shift the speed sensor or the Nozzle Block, so that it touches the metal of the mating face on the part that normally rotates (spindle or chamber). Then pull the speed sensor or Nozzle Block back to the specified gap of 1 to 3 mm. The system should have recognized and calibrated the speed sensor. If this is not the case, chose "RPM SENSOR" from the MENU. A graphics appears depicting the gap between speed sensor and chamber or spindle. Shift the speed sensor so that the graphic shows the correct distance.

Setting Wheel Rotation Direction

This separate unit must be mounted to a stationary part of the machine, located so that the outer face of the cylindrical portion of the “round” nozzle block, or the nozzle tip of the “L-shaped” flat nozzle block is

Chose the “DIRECTION” option from the MENU. This is specific to the Hydrokompenser. A menu appears, called “WHEEL ROTATION AND CHAMBER DIRECTION”. There is a choice of four menu items

1. AUTOMATIC ALWAYS – Every balance operation, the direction will be determined automatically by trial injections into all four chambers. This can be useful when the spindle swivels or otherwise changes direction.
2. AUTOMATIC ONCE – On the first balance cycle after selecting this option, the system will automatically determine the direction by performing trial injections into all four chambers. The result is stored and the auto-determination cycle is not run again.
3. SAME – This setting allows the operator to manually input the direction as SAME, without running the auto-determination cycle.
4. OPPOSITE – This allows the operator to manually input the direction as OPPOSITE, without running the auto-determination cycle. It is best to try either SAME or OPPOSITE and see which of the settings works best.

Operating Instructions

Hydrokompenser balancer operation is identical to standard mechanical systems. See SBS Operation and Specification Manual (L-4100-1) for details. There are only a few minor differences in the menus:

Whereas mechanical balancer manual operation buttons are designated M1, M2, M3, M4; indicating “Motor”, the Hydrokompenser manual operation buttons are designated C1, C2, C3, C4, indicating “Chamber”: Pressing these buttons activates the solenoid of the respective injection nozzle. This allows the operator to inject as much liquid as he wishes into each one of the chamber. This is typically used for diagnostic purposes. See the chapter on “Manual Balancing” in the SBS Operation and Specification Manual (L-4100-1) for details.

Displayed Error Messages

New self-diagnostic software has been incorporated into all SBS Balance Control Units. If a problem ever occurs with an SBS system, It is quickly reported on the front panel display in the form of an error code. Below is a listing of these codes, a description of when the Control Unit automatically runs each test, how each code is cleared, the definition of each error message, as well as the prescribed action to be taken by the user of the system. To further isolate defective components a series of test operations accompany some of the error codes. The following list is that of ALL error messages that appear with the Hydrokompenser system. Some of them are identical to error messages for mechanical balancers.

A— Checked continuously.....

message: **RPM OUT OF RANGE**
OPERATION RANGE IS
300-30000
CHECK RPM SENSOR

Clears automatically.

definition: Displayed if the RPM signal coming from the Speed Sensor is below 300 RPM or exceeds 30,000 RPM and the RPM number cannot be displayed.

action: Verify operating speed of the grinding machine. If the machine is running above 30,000 RPM, contact your SBS Balance System source for application consultation. If the machine is running within the operating speed limits, and this error message persists, this indicates a failure of the Speed Sensor in the Nozzle Block. The Nozzle Block should be returned for service, or the Speed Sensor replaced.

B— Checked Continuously.....

message: **VIB SENSOR DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.

definition: Vibration Sensor presence not detected. This could be caused by a defective sensor or by no sensor being connected.

action: Check sensor connections and try Power-On again. Continued error messages indicate the need for repairs to the Sensor.

C— Checked Continuously.....

message: **VIB SENSOR DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS –
SEE MANUAL

Clears automatically.

definition: Vibration sensor short circuit detected.

action: Disconnect the balancer from AC power before checking cables and connectors, and sensor for shorts. If the problem can not be isolated, the sensor, cable, and/or Control Unit should be returned for repair.

D— Checked at the end of a motor pulse .....

message: **VALVE DRIVER FAULT**
SHORT – CHECK CABLE
AND CONNECTORS –
SEE MANUAL

Cleared manually.

definition: Solenoid – short circuit detected.

action: Determine which is the defective component by swapping with another system, or by using the following diagnostic test. Return defective component for repairs. If in doubt, return all items.

test: Shut off the grinding spindle, and disconnect the Balance Head Cable from the Valve Block, but not from the Control Unit. Press MAN. Button on control to enter manual control mode. Press and hold down the first of the four manual C buttons for 15 seconds. Repeat with each of the manual C buttons (only one button can be actuated at a time).
If error E is displayed, clear this error, as it is expected. If no other error occurs during this test, then the problem is with the Valve Block. If error D or F is displayed, then continue on and perform part two of this test.

Disconnect the cable from the Control Unit, and repeat the above test, using all four manual C buttons. If error E is displayed, clear this error, as it is expected. If no other error occurs during this test, then the problem is with the Valve Block Cable. If error D or F is displayed, the problem is with the Control Unit.

E— Checked at the end of a motor pulse .....

message: **VALVE DRIVER FAULT**
OPEN – CHECK CABLE
AND CONNECTORS –
SEE MANUAL

Cleared manually.

definition: Solenoid – open circuit detected.

action: Determine which is the defective component by swapping with another system. Return defective component for repairs. If in doubt, return all items.

F— Checked at the end of a solenoid pulse .....

message: **VALVE DRIVER FAULT**
EXCESS CURRENT -
PERFORM MANUAL
FUNCTION TEST

Cleared manually.
Cleared by pressing Auto button.

definition: Solenoid – excessive current detected (short or stall).

action: Verify that both ends of the Balance Head Cable are properly attached. If connector pins are contaminated, clean with electrical contact cleaner. If problem persists, determine if the Valve Block Cable is the defective component by swapping with another system, or by using a voltmeter, and the enclosed Balance Head Cable Schematic in the L-4100-1 manual. Return defective cable or Vallve Block for repairs. If in doubt, return both items.

G— Checked continuously.....

message: **AUX POWER DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.
definition: 24V Auxiliary Supply low – fuse open.
action: Determine which is the defective component by swapping with another system, or by using the following diagnostic test. Return defective component for repairs. If in doubt, return all items.
test: Check for shorts in cables and connectors and re-initiate system check. If the error persists return Control Unit and cables for repair.

H— Checked Continuously.....

message: **RPM/CNC POWER DEFECT**
SHORT – CHECK CABLE
AND CONNECTORS -
SEE MANUAL

Clears automatically.
Cleared by pressing Auto button.
definition: 15V Auxiliary supply low – fuse open.
action: Check for shorts in Head/CNC cables and connectors and re-initiate system check. If the error persists return Control Unit and cables for repair. If you have the SBS system cabled to your CNC controller, verify that the CNC cable is free of electrical shorts. The CNC cable is not supplied with the SBS system, and repair is the responsibility of the user.

I— Checked during Auto Balance cycle.....

message: **AUTO-BALANCE FAILED**
LIMIT NOT REACHABLE
BEST BALANCE
ACHIEVED AT

Cleared manually.
Cleared by pressing Auto button.
definition: Auto Balance Failed – unable to reach limit.
action: Reset the PULSE setting to "CAUTIOUS", and verify system integrity as OK (*see: Trouble shooting Guide section*). If this error continues, there are two possible causes of this error.

1) LIMIT set too Low - The LIMIT must be set 0.2 higher than the Measured background vibration (*see: Other Sources of Vibration section*).
2) It is a signal that the Balance Head supplied is sized incorrectly for the application. Conduct the test described in the Verifying Balance Head Size section. If test results are outside suggested levels, contact your SBS Balance System source to discuss replacement.

J— Checked Continuously during Auto-Balance Cycle .....

message: **NO RPM SIGNAL**
CHECK CABLES
CHECK SPINDLE

Cleared automatically.
Cleared by pressing Auto button.

definition: No incoming RPM signal, possible open in RPM sensor circuit.
action: Ensure that spindle is running, with balancer cable attached at both balancer and control ends. Determine which is the defective component by swapping with another system. Return defective component for repairs. If in doubt, return all items.

K— Checked when Auto Balance Cycle Completed .....

message: **ABNORMAL CONDITION**
BAL CYCLE COMPLETED
AFTER ERROR DETECTED
SEE MANUAL

Checked when Auto Balance Cycle Completed.

definition: Balance cycle completed after error detected and cancelled, clears automatically.
action: No action required other than clearing manually from the Balancing screen.

L— Checked when Auto Balance Cycle Completed .....

message: **CIRCUIT FAILURE**
UNABLE TO MEASURE
VIBRATION
SEE MANUAL

definition: Signal acquisition circuit failed.
action: Clears automatically, no action required other than clearing manually from the Balancing screen. If the problem persists, the Control Unit should be returned for repair.

M— Checked Continuously during Auto-Balance Cycle .....

message: **FILTER CONTAC OPEN**
COOLANT FILTER CLOGGED -
CLEAN OR REPLACE
COOLANT FILTER

definition: Coolant filter indicator indicates clogged filter.
action: Stop Machine, clean or replace filter and restart balancing.

N— Checked when Auto Balance Cycle Completed.....

message: **CHAMBER FULL**
EMPTY CHAMBER AND
RESTART BALANCING
CHECK INITIAL UNBALANCE

definition: Balancing chambers might be full.
action: Stop Machine Spindle, empty chambers and restart balancing. If problem persists, either chambers are clogged with dirt and capacity is reduced, or unbalance is too big for installed chambers. Clears automatically.

O— Checked Continuously during Auto-Balance Cycle.....

message: **RPM UNSTABLE**
CHECK SPINDLE
CHECK MACHINE

definition: Unstable reading by RPM sensor.
action: Stop Machine, check setting of speed sensor. Check speed sensor operation, replace if necessary. Clears automatically.

P— Checked Continuously during Auto-Balance Cycle.....

message: **CHECK DIRECTION SETTING**

definition: Incorrect direction setting.
action: The Hydrokompenser needs a correct direction setting to identify the chamber sequence 1,2,3,4. Check setting. Try different setting, if necessary.

Troubleshooting

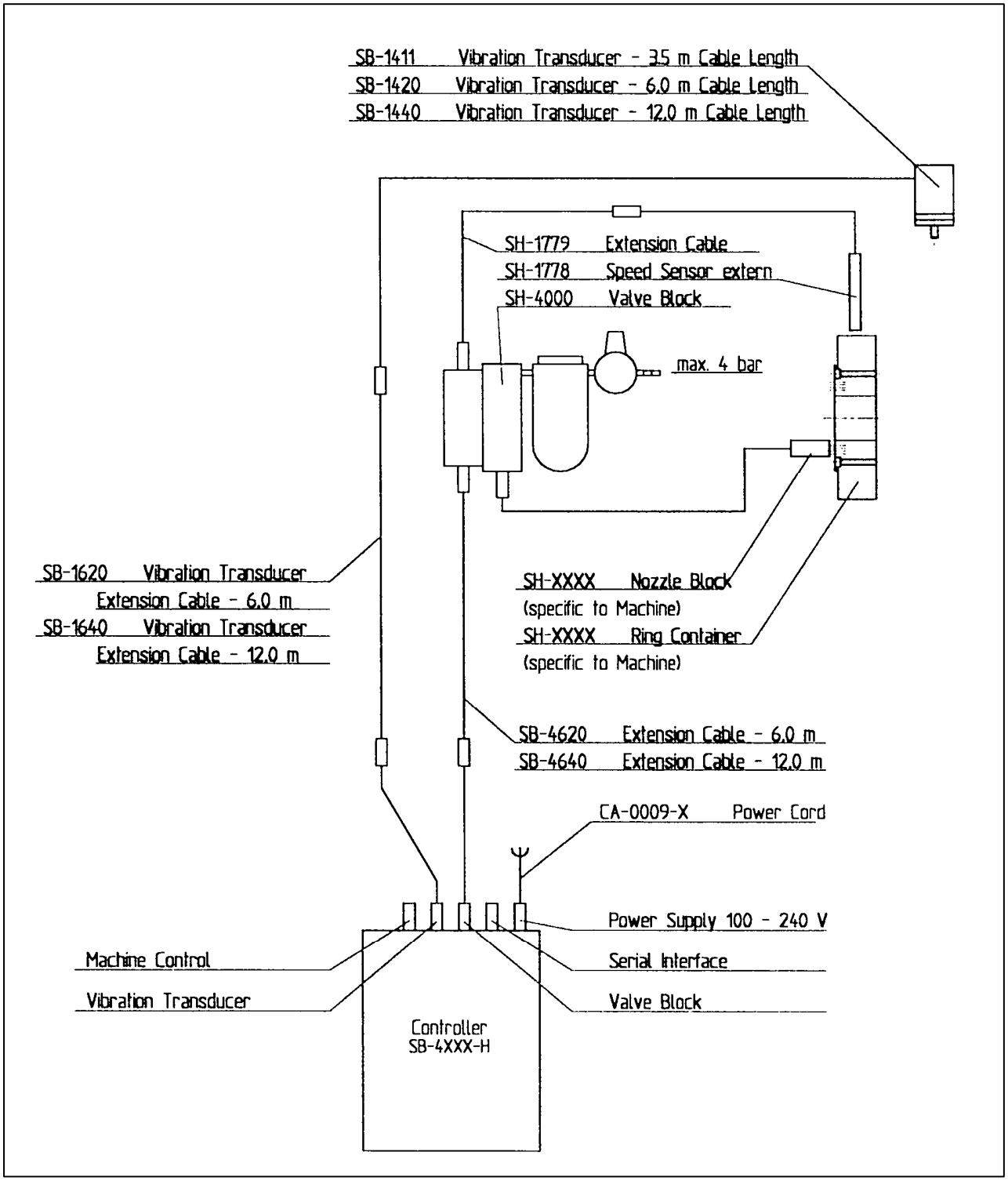
Failure	Cause	Remedy
Unbalance increases constantly in short time	Annular container leaks	Seal container
None or little change of unbalance while injecting	Annular container leaks, poor injection	Adjust valve block
	Hydraulic circuit does not operate properly	Check hydraulic as follows: — Select Manual Mode — Change unbalance display by about 1 pm by injecting coolant for example into valve 1 (chamber 1) This procedure tokes about 10-20 seconds. When operating valve 3 (chamber 3) the amount of vibration display has to be brought back to the basic initial value in the same time. The same procedure has to be repeated with valves 2 and 4 (chambers 2 and 4). If this cannot be done, the following measures have to be taken: — Check or - if necessary - change connections of valves 1, 2, 3, 4 — Adjust valve block correctly — Place chamber no. 1 opposite to injection valve 1. The liquid jet will not be reflected if positioning is correct. — Adjust coolant pressure in a way that the liquid jets of all valves are deflected after approx. 1 ½ ft (0.5 m).
System cannot be balanced to within tolerance	Interfering vibrations	Balance vibrating assemblies (e.g. drive motor) Change speed of possible second spindle Change position of vibration transducer at same level
	Coolant pressure	Adjust jet in a way that it is deflected after 1 ½ ft. (0.5 m) Water: 7 - 21 psi (0.5-1.5 bars) Oil: 14 – 58 psi (1-4 bars)
	Hydraulic circuit does not operate properly	See above
	Vibration transducer is placed at a bad spot	Fit vibration transducer in another position of machine
	Tolerance limit too low	Increase tolerance limit

Appendix A: Replacement Parts List

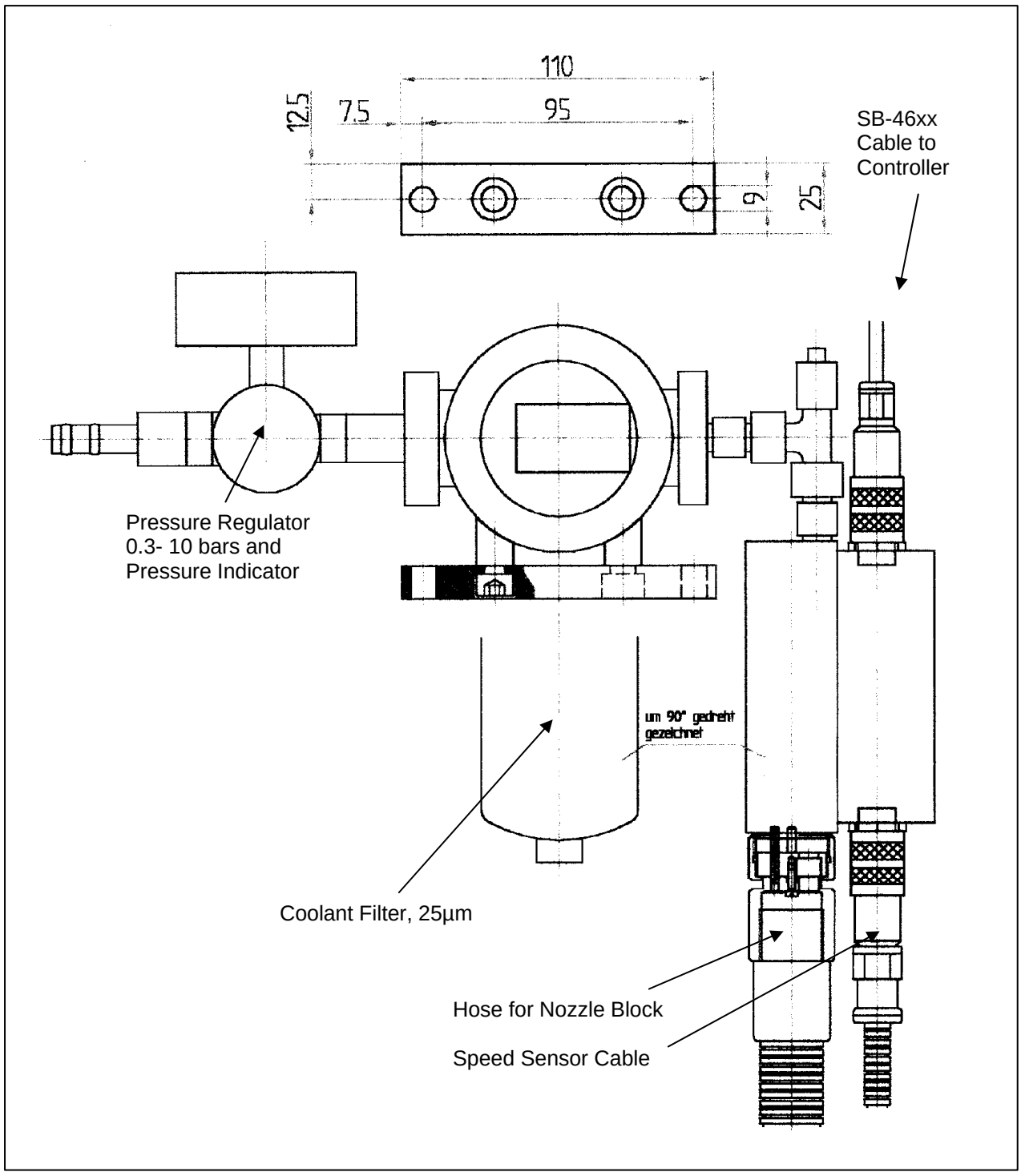
Part#	Description
Balancer Cables[1]	
SB-46xx	Valve Block Cable /SB-4500 series
Controls/ Options	
SB-43xx	Remote Keypad Cable for SB-4400
SB-24xx-L	CNC cable (standard lengths)
SB-4500-H	CONTROL UNIT Hydrokompenser (Expandable to 4 Channels)
SB-4400-H	CONTROL UNIT Hydrokompenser (Expandable to 2 Channels)
SB-4450	Remote Keypad (option for SB-4400)
SB-43xx	Remote Keypad connection cable (option for SB-4400)
SB-4475-H	CONTROL UNIT (w/ optional installed front panel)(Expandable to 2 Channels)
SB-4518	Additional Hydrokompenser (water balancer) Channel Card
SB-4522	AEMS Gap/Crash Monitoring System Card
Vibration Sensors[1]	
SB-14xx	Sensor Cable (standard lengths)
SB-16xx	Sensor Ext. Cable (standard lengths)
Control Mounting Hardware Options	
SB-0451	Rack Mount Panel: SB-4500 – 19”
SB-0441	Rack Mount Panel: SB-4400 ½ Rack DIN 3U
MC-0400	Control Mount Bracket: SB-4500
SB-0442	Control Mount Bracket: SB-4400
Other Parts[2]	
EC-5605	Control Unit Fuse, 3 amp slow-blo 5x20 (2 required)
CA-0009	Power Cordset
CA-0009-G	Power Cordset (Germany)
CA-0009-B	Power Cordset (British)
SH-4000	Complete Valve Block with Filter, Pressure regulator, Pressure Indicator and Clog Indicator
SH-1778	External Speed Sensor
SH-1779	Extension Cable for External Speed Sensor
CA-0121	12-pin Male DIN (control end plug of Balancer Cable for 46xx series cables)

1) xx = cable length in feet - standard options 11, 20, or 40 at standard price
2) Note that Nozzle Blocks and Ring Chambers are machine-specific parts. Please contact your Schmitt Representative for details.

Appendix B: System Component Overview



Appendix C: Valve Block Mounting



Dimensions in Millimeters