

SBS81 Series



PUSHCORP, INC.

Dallas,

May, 2013

**NEVER OPERATE THE
SBS81 MANUALLY**

**NEVER OPERATE THE SBS81 WITH
PERSONNEL IN THE WORK CELL**

DO NOT USE LUBRICATED AIR.

**This device requires a dry, non-lubricated
100 psi (6.9 bar) maximum air supply
filtered to 5 μ m and a 0.3 micron oil mist
separator.**

**Non-compliance with these requirements
will void the manufacturer's warranty.**

(See Section 3.4)

**All fasteners, mounting holes and pipe
threads on this tool are METRIC.**

**All *PushCorp, Inc.* electrical cables are rated for
high twist and flex robotic applications with a
minimum cable bending radius specification of
125mm (5 in). Cable damage resulting from
failure to abide by this specification will not be
covered under warranty.**

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1.0 Limited Warranty

Duration:

One year from date of delivery to the original purchaser.

Who gives this warranty (warrantor):

PushCorp, Inc.

Telephone: (972) 840-0208

Corporate Address:

P. O. Box 181915

Dallas, Texas 75218

Shipping Address:

3001 W. Kingsley Rd.

Garland, Texas 75041

Who receives this warranty (purchaser):

The original purchaser (other than for purposes of resale) of the *PushCorp, Inc.* product

What products are covered by this warranty:

Any *PushCorp, Inc.* Adjustable Force Device or Adjustable Force Device accessory supplied or manufactured by the Warrantor.

What is covered under this warranty:

Defects in material and/or workmanship which occur within the duration of the warranty period.

What is NOT covered in this warranty:

- A. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO ONE YEAR FROM THE DATE OF ORIGINAL PURCHASE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.
- B. ANY INCIDENTAL, INDIRECT, OR CONSEQUENTIAL LOSS, DAMAGE or EXPENSE THAT MAY RESULT FROM ANY DEFECT, FAILURE, MALFUNCTION OF THE *PUSHCORP, INC.* PRODUCT. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you.
- C. Any failure that results from an accident, purchaser's abuse, neglect, unauthorized repair or failure to operate the products in accordance with the instructions provided in the owner's manual(s) supplied with the product.

Responsibilities of the Warrantor under this warranty:

Repair or replace, at Warrantor's option, products or components which have failed within the duration of the warranty period.

Responsibilities of the purchaser under this warranty:

- A. Deliver or ship the *PushCorp, Inc.* product or component to PushCorp, Inc. Service Center, Dallas, TX. Freight and insurance costs, if any, must be borne by the purchaser.
- B. Use reasonable care in the operation and maintenance of the product as described in the owner's manual(s).

When warrantor will perform repair or replacement under this warranty:

Repair or replacement will be scheduled and serviced according to the normal work flow at the service center, and depending on the availability of replacement parts. Purchasers requiring quicker repair may receive such with payment of a *PushCorp, Inc.* predetermined expediting fee.

This Limited Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

2.0 General Overview

The PushCorp SBS81 Series Servo Belt Stand combines passive compliant force control and closed-loop servo motor speed control technology. The SBS81 has been designed from the ground up as a belt stand for robotic finishing with many new and unique features. Accurate force and speed control allows you to achieve unprecedented levels of quality and consistency. The SBS81 enables maximum flexibility for any part-in-hand grinding, sanding, buffing or polishing application. Linear compliance with 1.6 inches (40 mm) of travel and excellent access allow a robot to easily manipulate parts over the Belt Media. An important feature of the SBS81 Belt Stand is the high torque servo motor and belt drive. The belt drive system provides a 2:1 increase in torque at the contact wheels for heavy material removal.

The force control technology in the SBS81 is based on the *PushCorp* Passive AFD80 Series Force Devices. This technology has proven itself in thousands of hours of production robotic applications. An electronic regulator is sold with the SBS81 and this allows the SBS81's force to be varied from 0 to 50 lbs. (0 to 222 N). This regulator has a coarse adjustment and must be manually set to the desired force output. If the force must vary during the finishing process, then an electrically controlled proportional regulator is required. Very accurate force output requires a precision regulator that operates in a narrow pressure range.

The SBS81 has a number of notable features that contributes to ease-of-use, and greater throughput. The Belt Media can be tracked remotely outside the work cell for convenience and user safety. When the Belt Media needs replacing the operator manually releases the tension using a lever mounted right on the unit. A belt tension sensor is provided to notify the user that the Belt Media has not been tensioned. A belt break sensor is also provided to notify the user if the Belt Media should break. These sensors can be used by the customer to program faults to prevent the system from starting should the Belt Media not be tensioned, or to move the robot away, and stop the system should a belt break. These features protect the user and equipment, while also reducing downtime.

In most any finishing process, consistency is of paramount importance. For this reason the SBS81 is powered by a high torque servo motor with adjustable speed control that can be varied at any time during the finishing process. The SBS81 has a 5.7 horsepower (4.28 kW) motor that supplies 14.7 lb•ft (20 N•m) of torque and a maximum speed of 2000 RPM at the contact wheels. This provides a range of Belt Media surface speeds up to 7330 SFPM (Surface Feet Per Minute). The SBS81 requires 14 inch (356 mm) diameter Contact Wheels with a width of 1", 2", 3", or 4". The unit is setup to use standard 132 inch long Belt Media. For multi-media finishing applications, the rubber contact wheel can be replaced with Scotchbrite™, or cloth wheels. This flexibility allows the SBS81 to perform a wide variety of finishing applications.

3.0 Installation

3.1 Mounting the SBS81

The SBS81 Servo Belt Stand is secured by four (4) fasteners passing through mounting holes located in the Base Plate (See Figure 4). The Base Plate mounting hole locations are shown in Figure 1. The SBS81 must be securely mounted to keep the unit from moving during operation. The unit must be mounted level to achieve the desired force output at the Contact Wheels. A spirit level can be placed on the top of the Belt Stand and shims can be inserted under the Base Plate as required.

WARNING: Do NOT operate the unit without first mounting it securely.

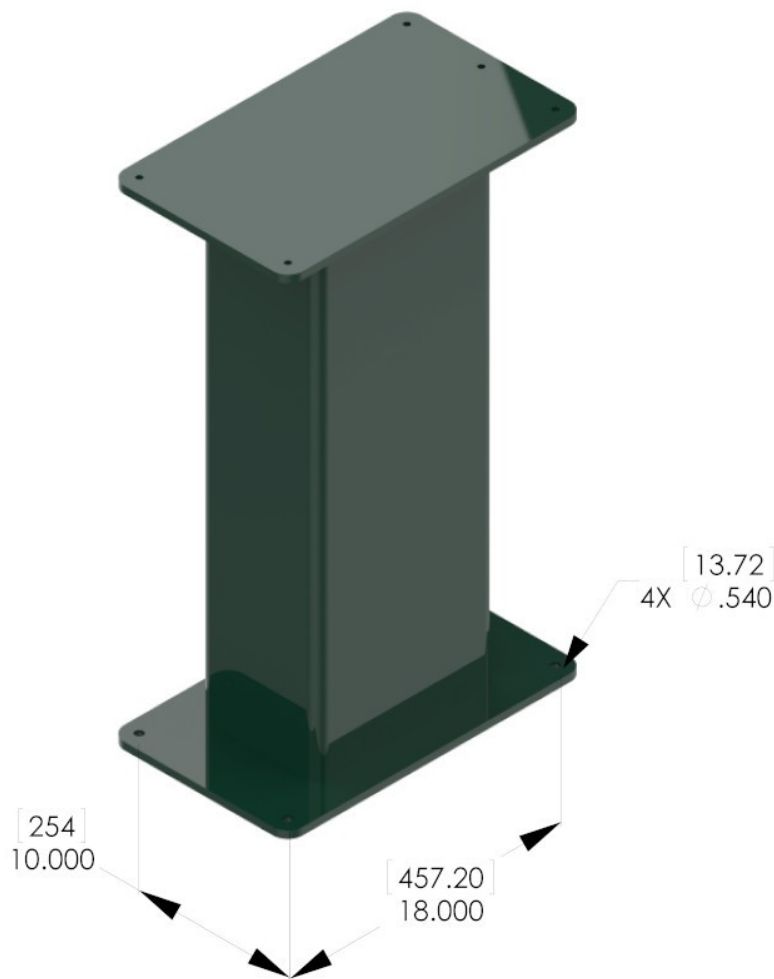


Figure 1. SBS81 Base Plate

The SBS81 attaches with four (4) fasteners, 1/2 inch (12 mm) in diameter. These fasteners are to be provided by the installer.

3.2 Electrical Control Box

An electrical control box is to be included in the standard system. It is meant to be wall mounted outside the robot work area in a relatively clean environment.

If utilizing an ethernet IP panel, please refer to the following link for more information:

[BRSCON-EIP](#)

If utilizing a raw s724 amplifier, please refer to the following link for more information:

[S724](#)

3.3 Pneumatic Connections

The SBS81 Belt Stand requires a dry, non-lubricated, 5 micron filtered, 80 to 100 psi (5 to 7 Bar) air supply with a 0.3 micron oil mist separator. Failure to provide supply air to these specifications can degrade performance and will void any warranty repairs concerning pneumatic components. Additionally, a *minimum* 80 psi (5 Bar) air pressure must be maintained for the device to operate within published specifications. Low air pressure will cause inferior force control performance and not allow the Belt Media to be properly tensioned.

The pneumatic supply system should be configured as shown in Figure 3.

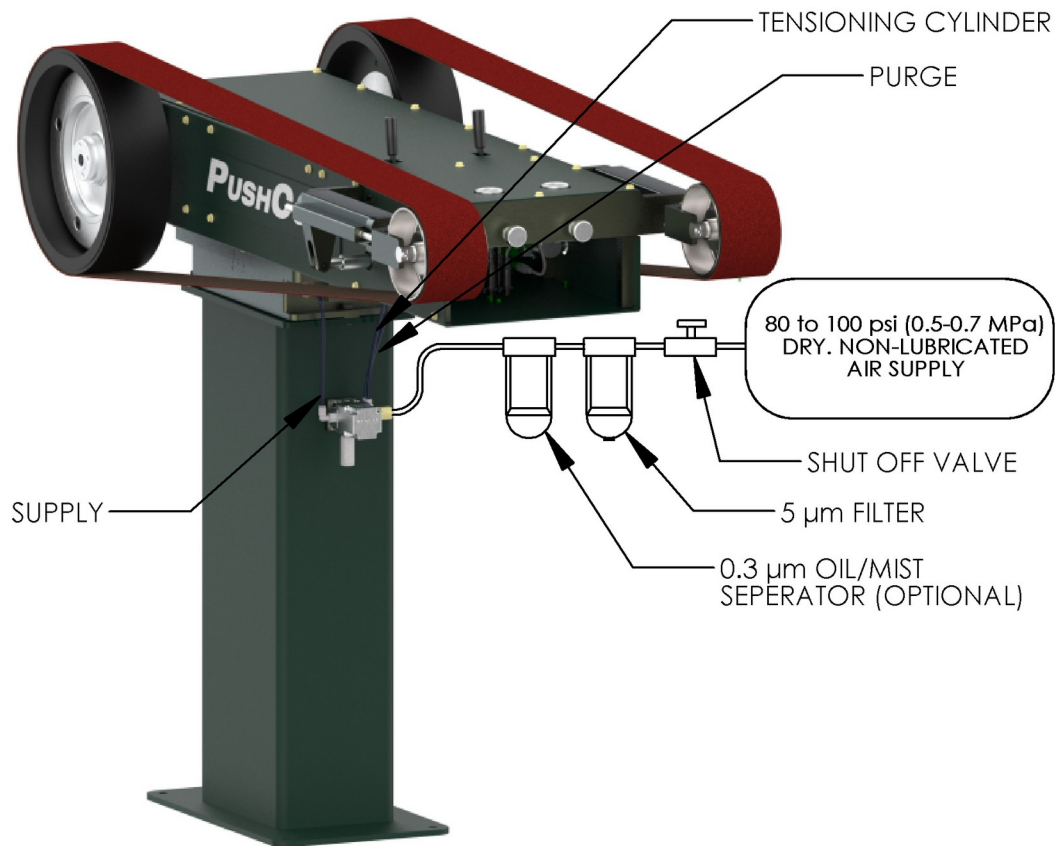


Figure 4. Pneumatic configuration

WARNING: If water condensation is a problem in your air supply system, an air dryer device is highly recommended. Moisture inside the device will cause premature failure that will not be covered under warranty.

The SBS81 Belt Stand maintains a positive air pressure to impede the infiltration of contaminate materials. It is important to provide a continuous compressed air supply to the device at all times if the work environment contains airborne contaminants. If the environment is clean during non-operational periods, the air supply to the device may be shut off.

The SBS81 has one pneumatic input, an R 1/8 (Metric) port located on the SBS81 Control Box (Figure 3). This port supplies all the air needed to operate the Belt Stand. Before connecting the supply to the air fitting, open the supply valve to blow out any contaminants which may be in the line. Charge the supply line with compressed air and verify that there are no air leaks and that there is a minimum of 80 psi (5 Bar). If a minimum air pressure of 80 PSI cannot be achieved, then an auxiliary air compressor or booster pump must be installed.

4.0 Operation

4.1 Belt Media Installation and Removal

The SBS81 uses 1", 2", 3", or 4" wide by 132" long Belt Media. To install new Belt Media, verify the servo motor and robot are disabled, then position the Belt Media Tension Release Lever towards the Contact Wheels of the SBS81, which releases the tension on the Belt Media. Install new Belt Media over the Contact Wheel and the Tracking Wheel as shown in Figure 4. Then tension the Belt Media by positioning the Belt Tension Release Lever to its rearward position. To remove the Belt Media reverse the previous steps.

Proper tension is required for each Belt Media width and type. The Belt Tension Pressure Adjustment Knobs are located at the rear of the machine, see Figure 4. The Belt Media tension should never be adjusted while the machine is operating. Belt Media Tension Pressure Gauges are located on the top of the machine to allow accurate setting of the pressure. The following chart is only a guideline for proper Belt Media tension pressures. The user is responsible for contacting the Belt Media manufacturer for the correct Belt Media tension.

Belt Width	Belt Media Tension Pressure	Belt Media Tension
1"	0.3 Mpa	43 lbs. (190 N)
2"	0.4 MPa	57 lbs. (254 N)
3"	0.5 MPa	71 lbs. (316 N)
4"	0.6 MPa	85 lbs. (380 N)

.1 MPa Belt Media Pressure Gauge = 14.2 lbs. (63.1 N) Belt Media Tension

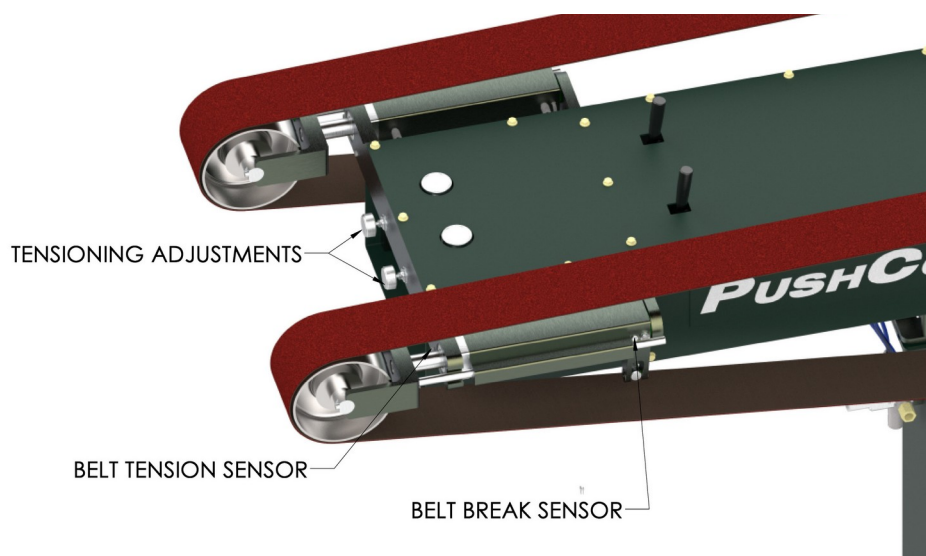


Figure 5. Tensioning Adjustments and Belt Break Sensors

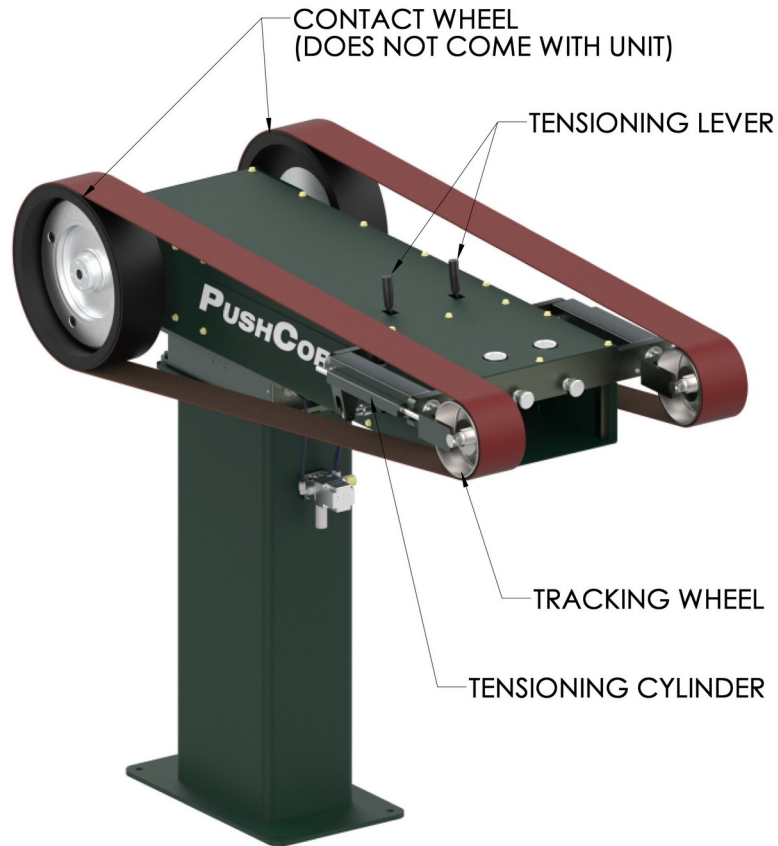


Figure 6. Belt Tensioning Components

4.2 Slack Arm

An optional slack/platten arm can be mounted inline with the contact wheel to provide longer abrasive life (148" [3759.2 mm]) and flexibility in the finishing process. The platten is a flat metal bracket shown in Figure 7. For parts that require a very flat surface, this component can be used by pressing the part against its face during the grinding process. This will help to maintain or create a flat surface. For more complex geometries the platten can be removed as seen in Figure 8. This will allow the belt to wrap around contoured geometries and make it easier for blending processes. The slack/platten arm can be added to one or both sides depending on the application. It is not necessary to have a symmetrical set up with a slack/platten arm used on both side.

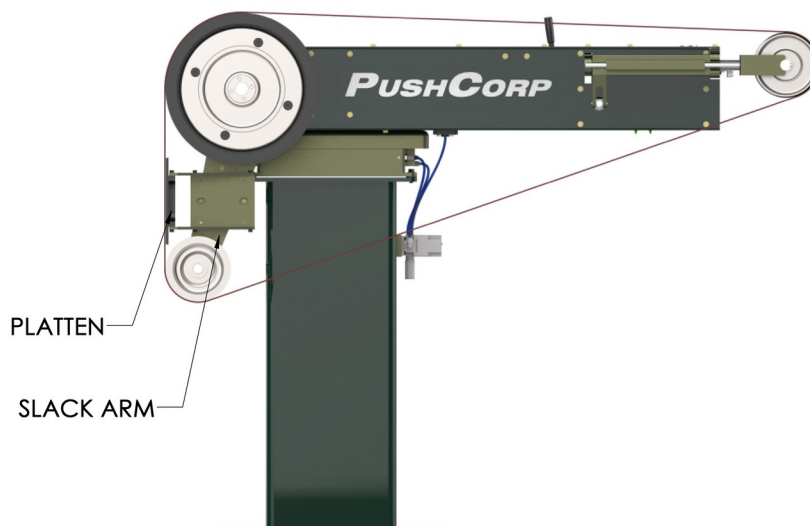


Figure 7. Slack Arm with Platten

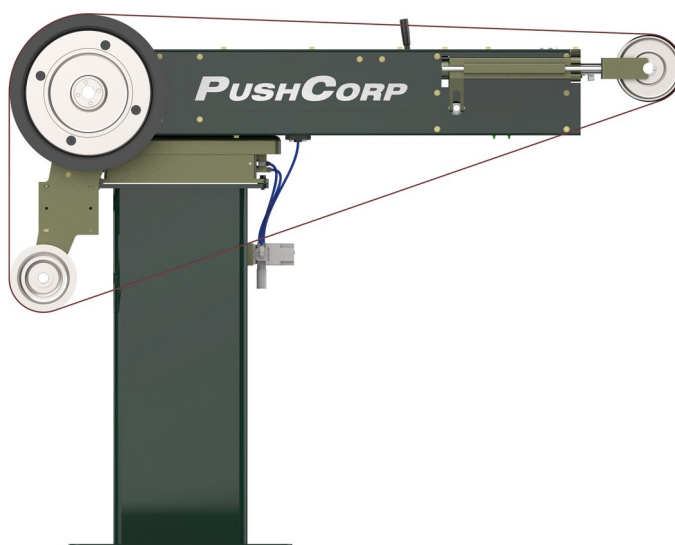


Figure 8. Slack Arm without Platten

4.3 Belt Media Tracking

The SBS is equipped with linear actuators to adjust and hold the tracking of the belt media on the contact wheels. The equipped actuators are the only adjustment for the tracking – no manual adjustment is available. The user adjusts the tracking wheel by extending or retracting the linear actuator; causing the belt to track side to side on the contact wheel.

The belt can only be tracked while the contact wheel is rotating. 500 RPM is the recommended contact wheel speed for belt track adjustment. Attempting to track at higher RPM will cause the belt to track too quickly.

The two sides of the SBS track separately, so the user must take care which side to adjust.

The linear actuators cannot be back-driven, and will hold their positions when set.

4.4 Achieving Desired Force

The SBS81 uses a passive *80 Series* AFD to supply a compliant force from 2 to 100 lbs. (8 to 445 N). The passive force device requires the user to provide regulated air pressure to achieve a desired force output at the Contact Wheels. Use the following equations to determine the pressure required to achieve the desired output force:

$$F_a = (1.4 \times P_s) \quad \text{English units}$$
$$F_{am} = (89 \times P_s) \quad \text{Metric units}$$

Where:

F_a = Net applied force (lbs.) at Contact Wheels

F_{am} = Net applied force (N) at Contact Wheels

P_s = Supply pressure (psi or bar)

PushCorp has included a manual regulator in the SBS81 Control Box to allow for quick set-up. A manually adjustable pressure regulator may be sufficient, but if remote operation of the force output is needed, then an electrically controlled proportional air regulator will be required. The accuracy of the force output is directly related to the precision and quality of the pressure regulator. For the most precise force output a regulator that operates in a limited range (i.e., 0-15 psi) is required.

4.5 Achieving Desired Belt Media Speed

The Belt Media speed and Output Shaft rpm is controlled via a +/- 10 VDC analog signal applied to Pins 4 and 5 of the User Interface Connector. The user must scale the command voltage to the servo motor amplifier from 0 to 10 Volts, which equates to a Belt Media speed of 0 to 7330 SFPM (Surface Feet Per Minute). The user is responsible for determining the maximum speed for their Belt Media. The SBS81 is factory limited to operate at a maximum Output Shaft rotational speed of 2000 rpm (7330 SFPM Belt Media speed). Figure 2 shows a simple circuit using a linear potentiometer to control Belt Media speed, however most installations will require a remote voltage command to vary the Belt Media speed and control the acceleration/deceleration of the unit.

4.5 Servo Motor Drive Belt Replacement

The SBS81 uses a 2:1 reduction timing belt drive to transfer power from the Servo Motor to the Contact Wheels. This drive incorporates a high-strength Gates Poly Chain GT2 belt, PushCorp Part No. PAR01889-1. Should this Drive Belt ever require replacement, contact PushCorp for the proper procedure.

4.6 Contact Wheel Replacement

Contact Wheels are not provided with the SBS81, as the user must determine the proper style and hardness for their specific application. The 14" diameter Contact Wheels are easily installed or replaced on the SBS81. They are available in different widths (1", 2", 3", or 4"), durometers (hardness), and surface types (plain or serrated). Using different width Contact Wheels on the SBS81 does not require any modifications to the unit. Contact Wheels should be ordered directly from the manufacturer, Contact Rubber Corp., 8635 198th Avenue, Bristol, WI, 53104, Tel: 262-857-2361, Fax: 262-857-9483. The SBS81 uses C-134 type Contact Wheels. There are four (4) M10x1.5 Flat Head Socket Screws on the Contact Wheel hub that must be removed to change the Contact Wheel. After removing the screws the hub will split allowing the Contact Wheel to be easily removed. Install a Contact Wheel on the hub and replace the removed hub and the four (4) screws. Tighten the screws to 30 ft.-lbs. (40 N·m).

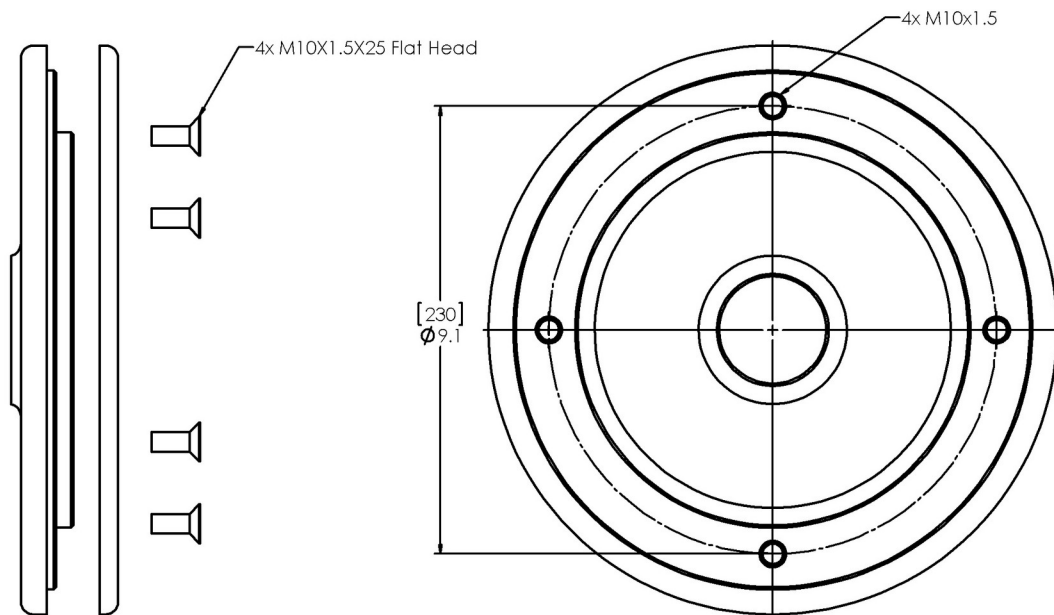


Figure 5. Contact Wheel Dimensions



Figure 6. Contact Wheel Stack Up

4.7 Contact Wheel Position Feedback

The SBS81 comes equipped with an internal potentiometer that provides a 0-10 volt signal based on the linear position of the Contact Wheels. The voltage signal is at a minimum value when the Contact Wheels are pushed back against the rubber stops, and a maximum value when the Contact Wheels are pulled forward against the rubber stops. The total linear compliant stroke is 1.6 in. (40 mm).

The linear position signal must be calibrated for each installation. User calibration is easily accomplished using the following steps.

1. Turn off the supply air to the SBS81
2. Move the Contact Wheels to the full rearward (negative) position.

3. Read the voltage signal on Pin 13 of the User Interface Connector. Record this voltage for future reference. This will be referred to as V_{neg} .
4. Move the Contact Wheels to the full forward (positive) position.
5. Read the voltage signal on Pin 13 of the User Interface Connector. Record this voltage for future reference. This will be referred to as V_{pos} .
6. The position of the Contact Wheels can now be determined by measuring the current voltage (V_m) on Pin 13 of the User Interface Connector, and inserting the value into the following equation:

$$p = 1.6 \text{ in.} \times \left(\frac{V_m - V_{neg}}{V_{pos} - V_{neg}} \right) \text{ (English units)}$$

$$p = 40 \text{ mm} \times \left(\frac{V_m - V_{neg}}{V_{pos} - V_{neg}} \right) \text{ (Metric units)}$$

Where,

p = Contact Wheel Position (in., mm)

V_m = Voltage measured on PIN 12 (V)

V_{neg} = Calibrated voltage at fully negative Carriage position (V), (0 inch, 0 mm)

V_{pos} = Calibrated voltage at fully positive Carriage position (V), (1.6 inch, 40 mm)

5.0 Technical Specifications

Maximum Applied Force:	100 lbs. (444N)
Torque:	14.7 lb-ft [20 N·m]
Belt Speed:	100-7330 SFPM
Contact Wheels:	1"-4" Widths, 14" Dia
Abrasive Belt Media:	1"-4" Widths, 132" Length
Weight:	450 lbs. (204 kg)
Force Scale Factor:	1.4 lbs/psi (890 N/MPa)
Compliant Stroke:	1.6 in. (40 mm)
Supply air:	Non-lubricated, Dry, 5µm Filtered, 100 psi (0.7 MPa) Max.
Supply Voltage:	240 VAC, 3-Phase
Max. Cont. Current:	30 Amps
Max. Peak Current:	60 Amps (2 Seconds)

Specifications subject to change without notice.

Fastener Tightening Torque Specs					
Fastener Size	Torque			Minimum Depth	
	in.-lbs.	ft.-lbs.	N·m	in.	mm
M4 x .7	50	4.2	5.6	0.17	4.3

M5 x .8	85	7.1	9.6	0.21	5.3
M6 x 1	140	11.7	15.8	0.25	6.3
M8 x 1.25	348	29.0	39.3	0.33	8.4
M10 x 1.5	600	50.0	67.8	0.41	10.5