Selecting an Enidine Air Spring for Actuation

Application Worksheet: Actuation (Metric)

1. Total Force required for Actuation (F_t): _____ kg x 9,8 = _____ N	
2. Number of Actuators (n): _____	
3. Force per Actuator (F) = $\frac{F_t}{n}$ = _____ = _____ N	
4. Available Air Pressure at the Point of Installation (P): _____ bars	
5. Corrected Force (F_C) = $\frac{F \times 7 \text{ bars}}{P}$ = _____ x 7*	F_C = _____ N
6. Stroke Required (S): _____ mm	S = _____ mm
7. An internal bumper will be required if any of the following conditions occur: • External compression stops are not provided. • Severe impacting at the compressed height of the Air Spring. • Operation of vibrating equipment on a deflated Air Spring. Indicate "Yes" if any of these conditions occur, "No" if they do not. If "Yes," select an Air Spring with an internal bumper.	❑ Yes ❑ No
8. Is a constant actuation force required for this application? If "Yes," consider only the Sleeve and Rolling Lobe Type Air Springs.	❑ Yes ❑ No
9. Working Temperature Range: **	_____ °C to _____ °C

** All Force values in the Selection Chart are based on a maximum operating pressure of 7 bars. Actual force capabilities of the Air Spring depend on the air pressure available. The Corrected Force calculation compensates for available air pressure.*

*** Working Temperature Range for Sleeve Type and Bellows Type YI-1B5, YI-1B6, YI-1B7, YI-1B8; YI-2B6, YI-2B7, YI-2B8 is -40°C to 100°C. Working Temperature Range for all other Air Springs is -55°C to 70°C.*

Sizing Instructions

Step 1: Fill out the Application Worksheet.

Step 2: In most applications a constant actuation force over the stroke is not required and sizing should begin with Single Convolute Bellows Type Air Springs. However, if a constant actuation force over the stroke is required, consider only the Sleeve and Rolling Lobe Type Air Springs.

Step 3: Refer to the Selection Chart under *Actuation Specifications.* In the *Force (N) At A Stroke Of:* Data Table choose the column that is equal to or exceeds the Stroke Required (S) (i.e., if a stroke of 64 mm is required, refer to the *75 mm* column). Identify the first Air Spring model that will generate a force equal to or greater than the Corrected Force (F_C) required. This is the Air Spring that will best serve your application. Select a model that includes an internal bumper if one is needed in the application. Availability of internal bumpers can be found under the *Features* Table for each Air Spring.

Step 4: Verify the *Envelope Dimensions* of the selected Air Spring to ensure that the Air Spring will fit the application. Allow a fifty (50) mm clearance on the diameter to prevent abrasion of the flex member. Select the *Model Number* that provides the *Features* and *Mounting Dimensions* required for the application.

Installation Consideration

- External extension stops are required to limit the extension of the Air Spring(s).
- The path of motion must be guided as Air Springs provide little lateral stability.

Sample Problem

A 1400 kg conveyor carrying a 500 kg package needs to be lifted 45 mm to transfer the package to another conveyor. There will be four (4) Actuators utilized and the warehouse has air lines with 3,5 bars. A constant actuation force is not required. Ambient temperature is 20°C. There is a 305 mm square space to house each Air Spring. Compression and extension stops are provided. Any *Air Fitting Port* and *End Retainer Style* would be acceptable.

Step 1: From the completed Application Worksheet, we know:

- Corrected Force per Actuator is 9310 N
- Stroke Required is 45 mm.
- An internal bumper is not required.
- A constant actuation force is not required.
- Working Temperature is 20°C.

Step 2: A constant force is not needed. Therefore, all Air Spring types are considered, beginning with Single Convolute Bellows.

Step 3: In the *50 mm* column under the *Force (N) At A Stroke Of:* Data Table, identify an Air Spring that can generate 9310 N of force. No internal bumper is required. Model YI-1B6-535 is selected.

Step 4: The maximum diameter of a YI-1B6-535 is 178 mm. Therefore, we need a 228 mm diameter space to house the Air Spring. A 305 mm square space will easily house the Air Spring. Any *Air Fitting Port* and *End Retainer Style* would be acceptable. Model YI-1B6-535 is selected.

Selecting an Enidine Air Spring for Vibration Isolation

Application Worksheet: Vibration Isolation (Metric)

1. Total Load (W_t): _____ kg x 9,8 = _____ N	
2. Number of Isolators (n): _____	
3. Load per Isolator (W) = $\frac{W_t}{n}$ = _____ = _____ N	
4. Available Air Pressure at the Point of Installation (P): _____ bars ***	
5. Corrected Load (W_C) = $\frac{W \times 7 \text{ bars}}{P}$ = $\frac{\quad \times 7^*}{}$	W_C = _____ N
6. Input Excitation Frequency (f_i) = _____ CPM (RPM)	f_i = _____ CPM (RPM)
7. An internal bumper will be required if any of the following conditions occur: • External compression stops are not provided. • Severe impacting at the compressed height of the Air Spring. • Operation of vibrating equipment on a deflated Air Spring. Indicate "Yes" if any of these conditions occur, "No" if they do not. If "Yes," select an Air Spring with an internal bumper.	❑ Yes ❑ No
8. Working Temperature Range: **	_____ °C to _____ °C

* *All Load values in the Selection Charts are based on a maximum operating pressure of 7 bars. Actual load bearing capabilities of the Air Spring depend on the air pressure available. The Corrected Load calculation compensates for available air pressure.*

** *Working Temperature Range for Sleeve Type and Bellows Type YI-1B5, YI-1B6, YI-1B7, YI-1B8; YI-2B6, YI-2B7, YI-2B8 is -40°C to 100°C. Working Temperature Range for all other Air Springs is -55°C to 70°C.*

*** *If no air lines are available a tank valve should be utilized; use 7 bars to select an Air Spring.*

Sizing Instructions

Step 1: Fill out the Application Worksheet.

Step 2: Refer to the Selection Chart under *Isolation Specifications*. In the *Isolator Load Range @ 7 bars* column, identify the first Air Spring model that will support the Corrected Load (W_C) required for the application. Check the Data Table for *Percent Isolation at an Input Frequency Of:* and compare the Input Excitation Frequency (f_i) to the input frequencies listed. Referring to the percent isolation for the model identified, estimate the approximate percent of isolation. If the first model identified does not meet the isolation requirements, then select the model that will **both** support the Corrected Load (W_C) and provide the required percent of isolation. Select a model that includes an internal bumper, if one is needed in the application. Availability of internal bumpers can be found under the *Features* Table for each Air Spring.

Step 3: Verify the *Envelope Dimensions* of the selected Air Spring to ensure that the Air Spring will fit the application. Allow a fifty (50) mm clearance on the diameter to prevent abrasion of the flex member. Select the *Model Number* that provides the *Features* and *Mounting Dimensions* required for the application.

Installation Consideration

- To ensure stability, the distance from the floor to the center of gravity of the load should not exceed the shortest distance between Air Springs.
- Air Springs provide little lateral stability. Therefore, be sure to include a method of stabilization.

Sample Problem

Vibrations generated by a pump weighing 3860 kg and rotating at 600 RPM are being transmitted into sensitive monitors causing them to malfunction. To control these damaging vibrations, four (4) Isolators located symmetrically about the center of gravity will be used. The ambient temperature range is 15°C to 60°C. Air lines are not available at the site. Therefore, a tank valve will be used. There is the possibility of depressurization of the Air Spring. An isolation of greater than 90% is required. There is a 228 mm diameter space to house the Air Spring. Any *Air Fitting Port* and *End Retainer Style* would be acceptable.

Step 1: From the completed Application Worksheet, we know:

- Load per Isolator is 9457 N
- Because a tank valve is being utilized, size using 7 bars
- Corrected Load per Isolator is 9457 N
- Working Temperature Range is 15°C to 60°C
- Because of the possibility of depressurization, an internal bumper is required
- Input Excitation Frequency is 600 CPM

Step 2: The first Air Spring model that has an internal bumper and is capable of supporting the Corrected Load Per Isolator is the YI-1B6-538. This Air Spring provides 90% isolation at 435 CPM and 97,4% at 870 CPM. Therefore, at 600 CPM the percent isolation is estimated to be 94%.

Step 3: The maximum diameter of a YI-1B6-538 is 178 mm. Therefore, we need a 228 mm diameter space to house the Air Spring. A 228 mm diameter is available. Any *Air Fitting Port* and *End Retainer Style* would be acceptable. Model YI-1B6-538 is selected.