

**KRÜGER**

***General Instructions***  
***(Axial Flow Fan)***

**TDA-TDF-TBE-TDB-TDS**



This manual is to guide the users in the proper storage, installation, operation and maintenance procedures to ensure maximum equipment life and trouble-free operation. **HANDLING AND MAINTENANCE SHOULD ALWAYS BE PERFORMED BY EXPERIENCED AND TRAINED PERSONNEL.**

## **RECEIVING, HANDLING AND STORAGE**

Rough handling during shipment and improper storage can cause damage that is not noticeable until the fan is in operation. This can be avoided with proper storage and handling techniques.

Fan should be hoisted with slings placed around the fan housing. Touch up the scratch coated surfaces during lifting, to prevent corrosion to occur at this area. Store the fan in a clean and dry place, preferably indoor to ensure fan shaft, bearing and fan casing are protected against dust and corrosion. Do not store the fan in a location where it will be subjected to vibration. This can cause the internal surface to rub against each other and damage the bearings.

## **START-UP CHECK LIST**

Before putting any fan into initial operation the manufacturer's instruction must be followed. Complete the following checklist to make sure that the fan is ready to run.

Lock out the primary and all secondary power sources.

Make sure the foundation or mounting arrangement and the duct connections are adequately designed in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

Check and tighten all hold-down (securing) bolts.

Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.

Spin impeller to see whether it rotates freely and is not grossly out of balance.

Inspect impeller for correct rotation for the fan design.

Check belt drive or coupling alignment, use recommended belt tension.

Check belt drive for proper sheave selection and make sure they are not reversed.

Properly secure all safety guards.

Inlet and outlet damper (if any) must be maintain 60% air volume, totally closed should be avoided.

Switch on the electrical supply and allow the fan to reach full speed.

Check carefully for :-

- (1) Excessive vibration
- (2) Unusual noise
- (3) Proper amperage and voltage values
- (4) Proper belt alignment

If any problem is indicated, SWITCH OFF IMMEDIATELY. Lock out the electrical supply, secure the fan impeller if there is a potential for wind milling. (impeller turning due to a draft through the system). Check carefully for the cause of the trouble and correct as necessary.

The fan may now be put into operation but during the first 8 hrs of running, it should be periodically observed and checked for excessive vibration and noise. Checks should be made of motor input current and motor & bearing temperature to ensure that they do not exceed manufacturer's recommendation. After 8 hrs of operation, the fan should be shut down to check the following items :-

- (1) All set screws and hold-down bolts
- (2) Belt drive alignment
- (3) Belt drive tension
- (4) Bearing housing temperature

After 24 hrs of the satisfactory operation, the fan should be shut down, and the drive belt tension should be readjusted to recommended tension.

## TROUBLE-SHOOTING

### Fan is developing or emitting abnormal or excessive noise

	Possible cause	Remedy
<b>Drive system</b>	<ul style="list-style-type: none"> <li>• Fan or motor sheave not properly tightened onto shaft</li> <li>• Misalign sheaves</li> <li>• Belt hitting Belt Guard</li> <li>• Belts are not tensioned enough and are too loose</li> <li>• Belts too tight</li> <li>• Belts wrong cross section</li> <li>• Belts worn</li> <li>• Belts oily or dirty</li> <li>• Belt guard is not properly fastened</li> <li>• Motor, motor base or fan not securely anchored or Secured</li> </ul>	<ul style="list-style-type: none"> <li>• Re-tightened the sheaves</li> <li>• Re-align the sheaves</li> <li>• Check fan &amp; motor sheave alignment &amp; belt tension</li> <li>• Increase the belt tension</li> <li>• Correct belt tension</li> <li>• Change to right type</li> <li>• Replace belts</li> <li>• Clean belts</li> <li>• Tighten the fasteners</li> <li>• Tighten the fasteners</li> </ul>
<b>Motor</b>	<ul style="list-style-type: none"> <li>• Lean-in cable not secure</li> <li>• Noisy motor bearings</li> <li>• Single phasing a 3 phase motor</li> <li>• Low voltage</li> <li>• Cooling fan striking shroud</li> <li>• Electromagnetic fault in motor</li> <li>• AC hum in motor or relay</li> <li>• Starting relay chatter</li> </ul>	<ul style="list-style-type: none"> <li>• Fasten the cable properly</li> <li>• Replace bearing</li> <li>• Check power supply</li> <li>• Check power supply</li> <li>• Check motor assembly</li> <li>• Replace motor</li> </ul>
<b>Fan Components</b>	<ul style="list-style-type: none"> <li>• Impeller loose on shaft</li> <li>• Impeller unbalance</li> <li>• Impeller not center in inlet or housing</li> <li>• Blades rotating close to structural member</li> <li>• Bearing defective or worn out</li> <li>• Bearing loose on bearing support or shaft</li> <li>• Foreign material inside bearing</li> <li>• Fretting corrosion between inner race and shaft</li> <li>• Bearing not sitting on flat surface</li> <li>• Rubbing noise between bearing seal and inner ring</li> <li>• Blades coinciding with an equal number of structural members</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten impeller</li> <li>• Balance impeller</li> <li>• Adjust impeller to center of inlet or housing</li> <li>• Correct the running clearance</li> <li>• Replace bearing</li> <li>• Re-tighten bearing</li> <li>• Clean bearing</li> <li>• Replace bearing or shaft</li> <li>• Re-adjust bearing</li> <li>• Replace bearing</li> </ul>

### Fan is vibrating excessively

	Possible cause	Remedy
<b>Impeller</b>	<ul style="list-style-type: none"> <li>• Impeller unbalanced due to deposits (dirt or grease)</li> <li>• Impeller unbalanced due to wear</li> </ul>	<ul style="list-style-type: none"> <li>• Clean impeller, rebalance the system</li> <li>• Replace impeller</li> </ul>
<b>Drive</b>	<ul style="list-style-type: none"> <li>• Unbalanced pulleys</li> <li>• Belts may vibrate excessively</li> </ul>	<ul style="list-style-type: none"> <li>• Balance the pulley or the system</li> <li>• Proper sheave alignment and adjust to correct belt tension</li> </ul>

### Required air volume not achieved

	Possible cause	Remedy
<b>Impeller</b>	<ul style="list-style-type: none"> <li>• Impeller/inlet dirty or clogged</li> <li>• Improper running clearance</li> <li>• Improper blade setting</li> <li>• Impeller installed or running wrong direction</li> <li>• Incorrect speed of impeller because of:               <ol style="list-style-type: none"> <li>i) Wrong motor speed</li> <li>ii) Belt drive ratio not correct</li> <li>iii) Too high slip of V-belt</li> <li>iv) Wrong calibration of inverter</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Clean the impeller or inlet</li> <li>• Change to correct clearance</li> <li>• Adjust to correct angle</li> <li>• Change to correct rotation by changing poles of electrical feed line to motor               <ol style="list-style-type: none"> <li>i) Change motor or belt drive</li> <li>ii) Change belt drive</li> <li>iii) Increase tension of belts</li> <li>iv) Adjust inverter calibration</li> </ol> </li> </ul>
<b>Duct System</b>	<ul style="list-style-type: none"> <li>• Shutters or dampers of the system are closed</li> <li>• Object obstructs fan or duct</li> <li>• Inlet guide vanes are partly close</li> <li>• Dampers closed</li> <li>• Registers closed</li> <li>• Leaks in supply duct</li> <li>• Obstructions near fan outlet or inlet</li> <li>• Sharp elbows near fan outlet or inlet</li> <li>• Improper designed turning vanes</li> <li>• The pressure losses of the duct system – suction or discharge side – are higher than calculated/expected try to find out at what duty point the fan actually is working! Pay special attention when using an axial fan</li> <li>• Insulating duct liner loose</li> <li>• Pressure resistance offered by the system higher than the design value</li> <li>• Fluid density higher than the design value</li> <li>• Actual system is more restrictive (more resistance to flow) than expected</li> <li>• Obstructed fan outlet inlets Elbows, cabinet walls or other obstructions restrict air flow. Inlet obstructions cause more restrictive systems but do not cause increased negative pressure readings near the fan inlet(s) Fan speed may be increased to counteract the effect of restricted fan inlet(s). Caution! Do not increase speed beyond the fan manufacturers recommendations</li> <li>• No straight duct at fan outlet (Fans which are normally used in duct system are tested with a length of straight duct at fan outlet. If there is no straight duct at the fan outlet, decreased performance may result. If it is not practical to install a straight section of duct at the fan outlet, the fan speed may be increased to overcome this pressure loss. Caution! Do not increase fan speed beyond the fan manufacturers recommendations.)</li> <li>• Projections, dampers or other obstruction in a part of the system where air velocity is high</li> <li>• Obstructions in high velocity air stream</li> </ul>	<ul style="list-style-type: none"> <li>• Open damper or IVC</li> <li>• Clear obstructed ducts</li> <li>• Open grill/diffuser damper</li> <li>• Open Damper</li> <li>• Open Register</li> <li>• Seal the Leakage</li> <li>• Clear obstruction</li> <li>• Redesign and change elbow</li> <li>• Redesign and change vanes</li> <li>• Modify duct design or try to eliminate turbulences by straighteners or increase fan speed to overcome unexpected losses (attention to available motor power and rpm limitation of fan)</li> </ul>

### Fan does not start or operate

	Possible cause	Remedy
<b>Electrical Supply</b>	<ul style="list-style-type: none"> <li>Blown fuses</li> <li>Electricity turned off</li> <li>Wrong voltage</li> <li>Failure of one or two phases</li> <li>Low voltage, excessive line drop or inadequate wire size</li> </ul>	<ul style="list-style-type: none"> <li>Check fuses/circuit breakers</li> <li>Check for switched off or disconnected</li> <li>Check for correct power supply</li> <li>Check for correct power supply</li> <li>Check for correct wire size</li> </ul>
<b>Motor</b>	<ul style="list-style-type: none"> <li>Motor not correctly connected</li> <li>Load inertia too large for motor</li> <li>Motor protection unit or switch are stopping as temperature are too high</li> <li>Motor too small and overload protector has broken circuit</li> </ul>	<ul style="list-style-type: none"> <li>Connect the motor according to the motor label</li> <li>Change motor</li> <li>Reduce temperatures, check and change insulation class, increase motor rating</li> <li>Change motor</li> </ul>
<b>Drive System</b>	<ul style="list-style-type: none"> <li>Broken belts</li> <li>Loose pulleys</li> </ul>	<ul style="list-style-type: none"> <li>Replace belt</li> <li>Tighten pulley</li> </ul>

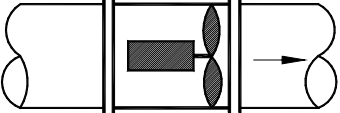
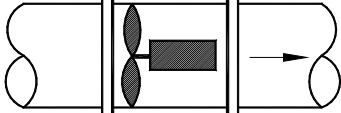
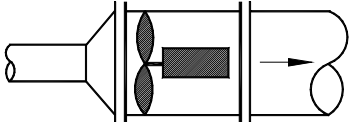
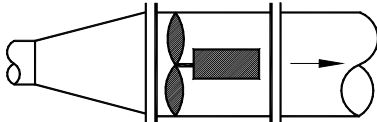
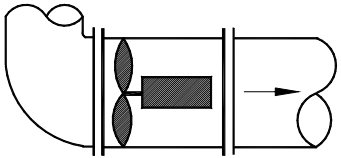
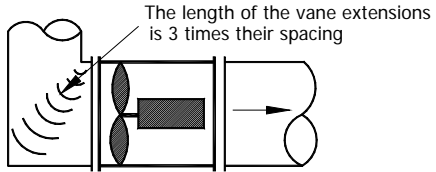
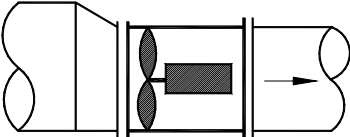
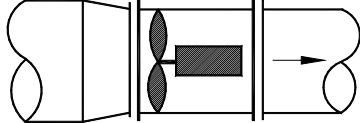
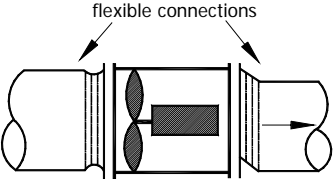
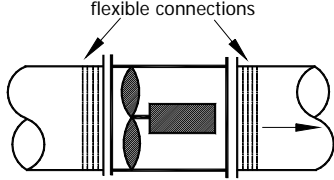
### Excessive air flow

	Possible cause	Remedy
<b>Duct System</b>	<ul style="list-style-type: none"> <li>Pressure resistance offered by the system lower than the design value</li> </ul>	
<b>Gas Density</b>	<ul style="list-style-type: none"> <li>Gas density higher than the design value</li> </ul>	

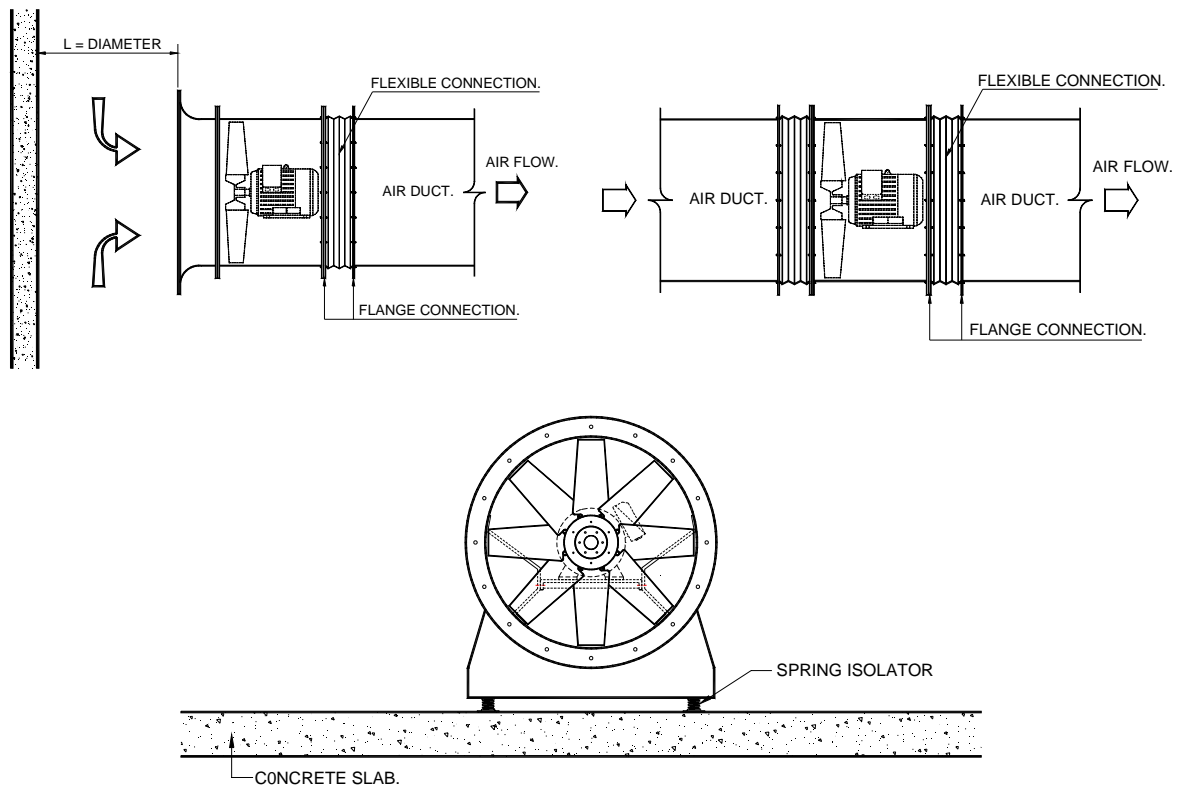
### High power absorption

	Possible cause	Remedy
<b>Impeller</b>	<ul style="list-style-type: none"> <li>Blade angle not set properly</li> </ul>	<ul style="list-style-type: none"> <li>Adjust blade angle</li> </ul>
<b>Motor</b>	<ul style="list-style-type: none"> <li>Faults in the motor windings</li> <li>Motor power supply voltage lower than the value indicated on the identification plate</li> </ul>	<ul style="list-style-type: none"> <li>Replace motor</li> <li>Check with motor supplier</li> </ul>
<b>Fan</b>	<ul style="list-style-type: none"> <li>Fan Air flow value lower than design value</li> </ul>	
<b>System</b>	<ul style="list-style-type: none"> <li>Oversized ductwork</li> <li>Filter(s) left out</li> <li>Access door are open</li> <li>Face and by-pass dampers oriented so coil dampers are open at same time by-pass dampers are open</li> </ul>	<ul style="list-style-type: none"> <li>Redesign ductwork</li> <li>Add in filter(s)</li> <li>Close access door</li> </ul>
<b>Gas Density</b>	<ul style="list-style-type: none"> <li>Calculated horsepower requirements based on light gas (eg. High temperature) but actual gas is heavy (eg. Cold start up)</li> </ul>	
<b>Fan selection</b>	<ul style="list-style-type: none"> <li>Fan not selected at efficient point of rating</li> </ul>	<ul style="list-style-type: none"> <li>Check selection</li> </ul>

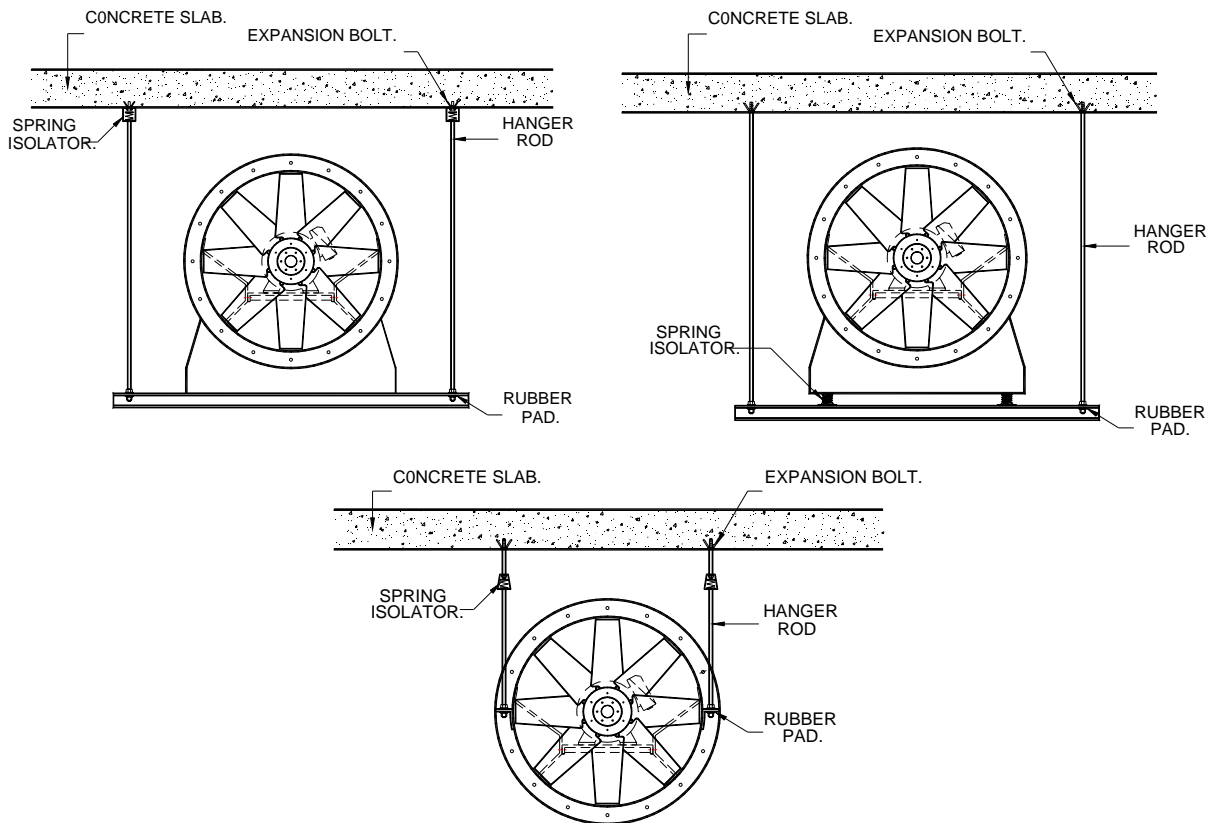
## GUIDELINES FOR DUCTED AXIAL FLOW FAN INSTALLATION

INCORRECT	CORRECT
<p>Motor upstream of impeller increases turbulence and noise</p> 	<p>Motor downstream from impeller minimizes turbulence and noise</p> 
<p>Abrupt inlet transition causes turbulence</p> 	<p>Gradual (1:7) expansion of the inlet duct avoids impeller turbulence</p> 
<p>Upstream radius elbow creates imbalance at inlet</p> 	<p>Square inlet elbow with extended trailing edge vanes delivers less turbulent airflow to fan inlet</p> <p>The length of the vane extensions is 3 times their spacing</p> 
<p>Assymetrical transition creates imbalanced load on fan, with excess turbulence and noise</p> 	<p>Symmetrical transition balances load on fan, which minimizes turbulence and noise</p> 
<p>Slack or offset flexible connections causes turbulent air flow</p> <p>flexible connections</p> 	<p>Taut, in-line flexible connections provide optional vibration isolation without creating turbulence</p> <p>flexible connections</p> 

## Installation Method

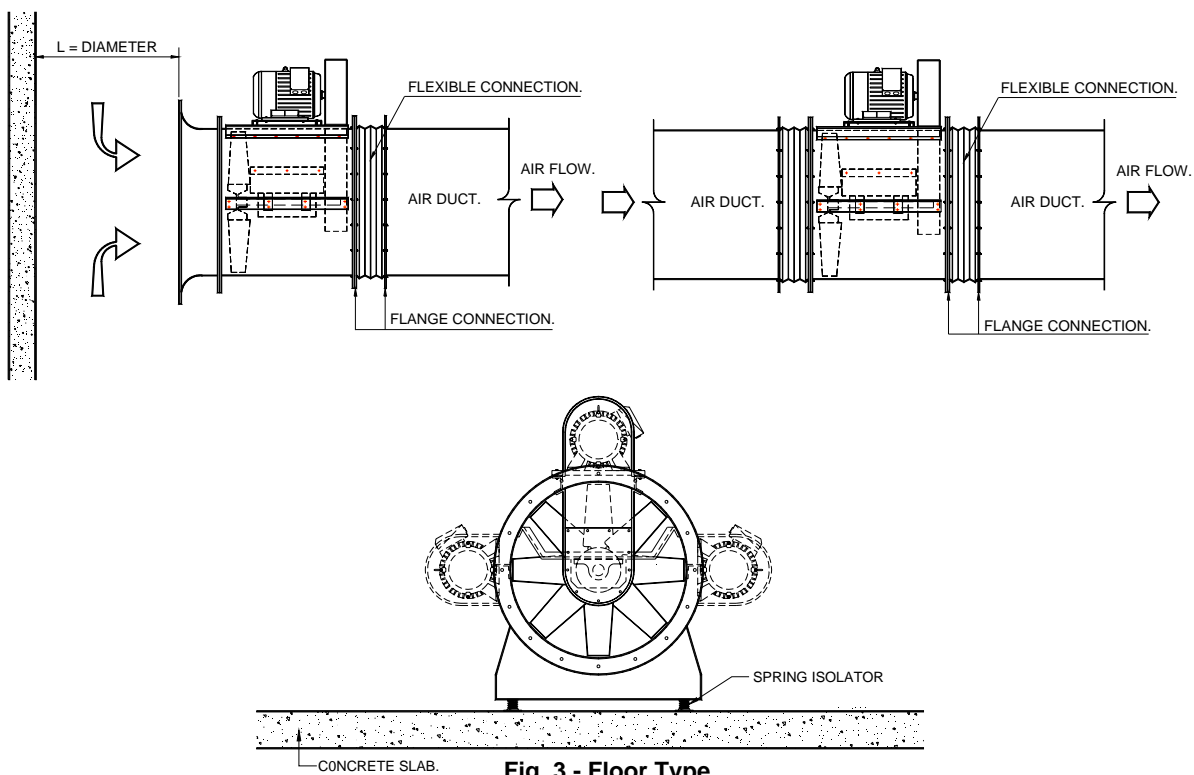


**Fig. 1 - Floor Type**

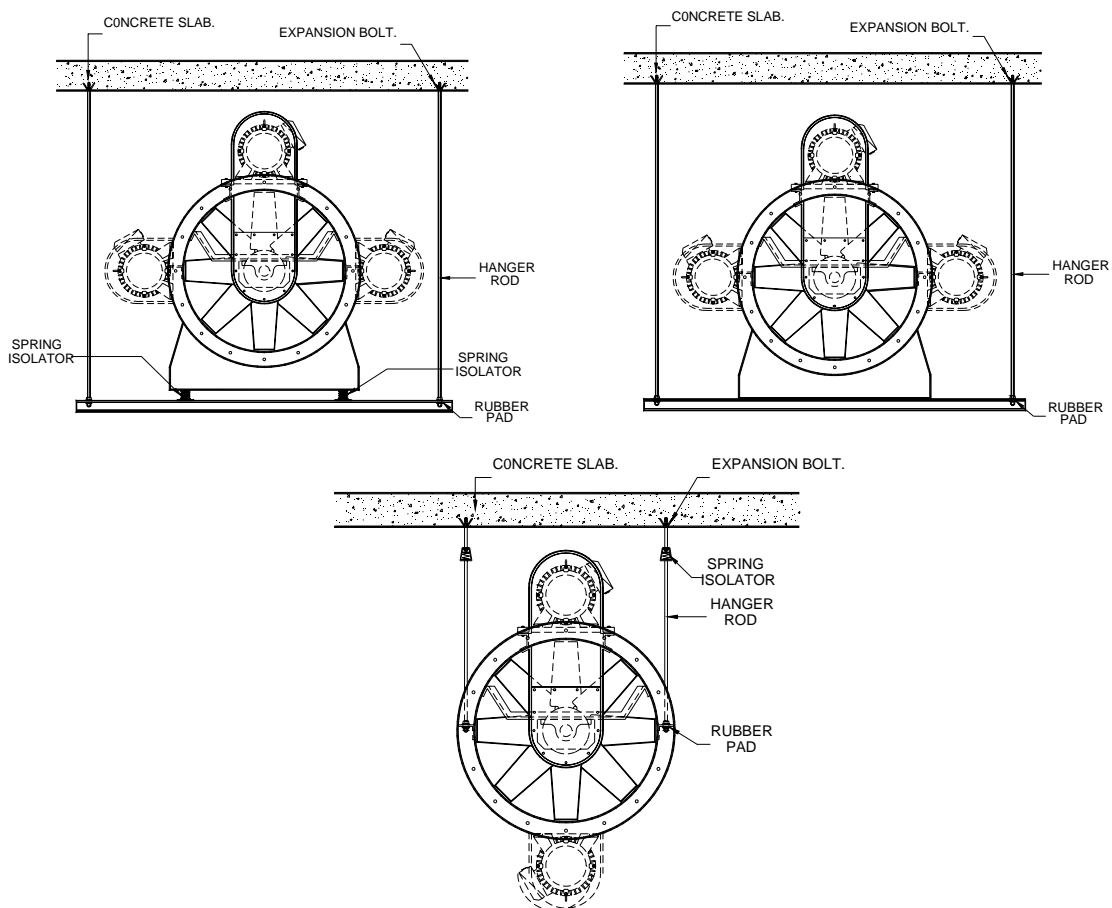


**Fig. 2 - Ceiling Type**

## Installation Method



**Fig. 3 - Floor Type**

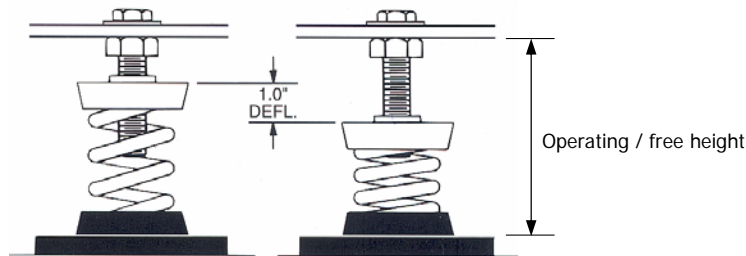


**Fig. 4 - Ceiling Type**



## VIBRATION ISOLATOR INSTALLATION

- Choose proper isolator  
(Isolator can be selected from Kruger selection programme)
- Adjust deflection based on the selected isolator.
- Maintain the operating / free height at the same level through step 2.  
(The entire assembly must be levelled)
- Check all the deflection and operating / free height is properly maintained.



## ROUTINE MAINTENANCE

Maintenance should always be performed by experienced and trained personnel. Do not attempt any maintenance on a fan unless the electrical supply has been locked out or tagged out and the impeller has been secured.

Under normal circumstances, handling clean air, the system should require cleaning only about a Year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

The fan impeller should be specially checked for build-up of material or dirt which may cause an Imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

Periodic inspection of the rotating assembly must be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue.

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