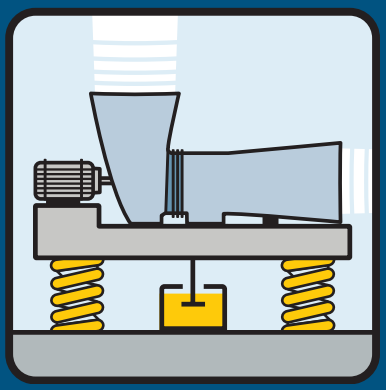
GERB
Vibration Control Systems

Spring Support of Fan Foundations



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Typical Spring Viscodamper® Combination

The most common fans in power plants are ID-, FD- and PA-fans of axial as well as radial type. Their imbalances caused by wear and tear during operation result in periodical dynamic forces, which are fully transmitted into the foundation and beyond. Therefore, fan foundation design must consider not only static but also these dynamic loads resulting ultimately in a foundation concept which is practical as well as acceptable in both the technical and economical way. Spring support of fans can conveniently meet these requirements. Worldwide acceptance of this concept as state of the art technology is of course, our best evidence.

Conventional fan foundations in power plants typically require very massive RC-blocks but this huge mass alone cannot stop the transmission of vibration into the soil/surrounding at all. It is mainly meant to suppress the bad effects of unintentional system resonances, which cannot be ruled out in this case, with very little knowledge of the exact dynamic properties of the soil. Even rigorous dynamic analysis has to be based on estimation and assessment even if the design is done by an expert.

There is also the risk of settlements, especially uneven settlements due to these vibrations. It is, therefore, already common practice to support the conventional foundation at several meters below ground level where the soil bearing capacity is much more than adequate for just the static loads. Alternatively, the foundation will have to be supported on piles. This may reduce the danger of settlements but it is on the other hand expensive and time-consuming.

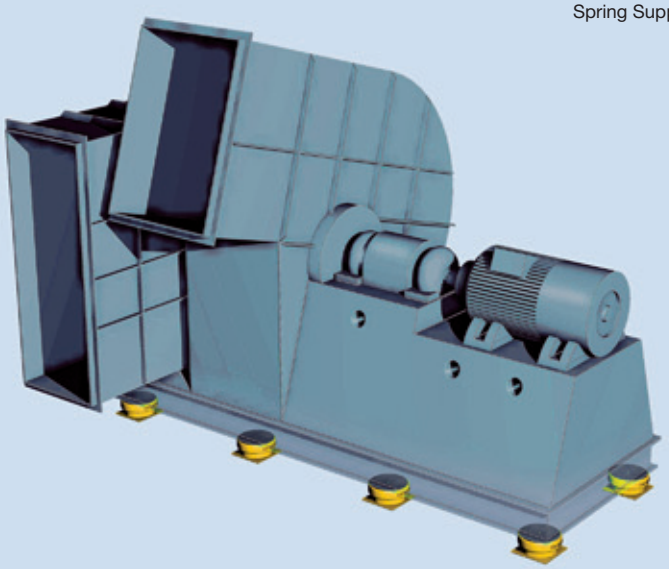
Such a conventional foundation should therefore be replaced by a better alternative. GERB recommends dynamic uncoupling of the fan foundation from the soil by means of spring units equipped with high quality, fatigue free coil springs and non-aging Viscodampers®.

This system provides the following advantages:

- Instead of a massive RC-block, the fan foundation is reduced to a RC-slab of a limited thickness. When spring supported the dynamic behaviour of this **system can be exactly calculated** and well predicted.
- Low natural system frequencies are far away from the speed of the fan ensuring a **very smooth running of the fan** itself.
- The fan foundation can be in this way dynamically fully uncoupled from the sub foundation and soil, no matter how well soil conditions are defined. The **vibration isolation efficiency is very high** and may reach more than 95 %. In this way the **entire surrounding structure** can be expected to be **absolutely vibration free.**
- The **substructure** below the spring system **can be designed for the dead load of the machine and its RC-deck only.** It may be reduced to either walls or frames which will conveniently rest on soil without settlement problems.
  Piles, wherever required for a conventional foundation, **can be greatly reduced in numbers or even fully eliminated.**
- Such highly flexible spring support combined with Viscodampers® will even result in **lower stresses in the machine itself, i.e. an increase in bearing life, larger maintenance free periods and higher machine availability.**

Typical Spring Unit with Damping

Spring Supported Radial Fan



This foundation concept represents, therefore, an economic and timesaving solution providing besides good vibration isolation an excellent protection against settlements and even against earthquakes.

The danger of uneven settlements is greatly reduced due to following reasons:

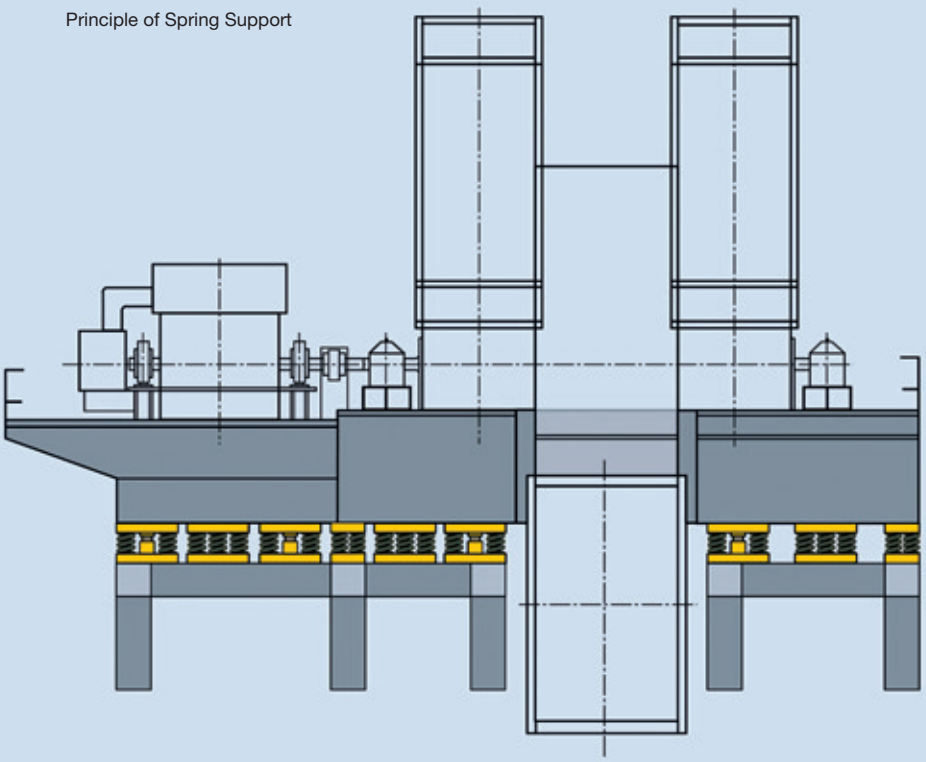
- The soil is only statically loaded, while most settlements after commissioning are caused by dynamic loads.
- Up to a certain extent uneven settlements are automatically levelled out due to the flexibility of the springs.
- If settlements should inspite of all this reach critical dimensions, they can easily be corrected by shimming on spring level in very short time.

Spring supported fan foundation still offer another advantage:

- While conventional fan foundations in power plants need large excavated areas creating usually obstacles for the movement of cranes and other equipment, this problem can be very well eliminated when using spring systems. A wall or simple frame type sub structure can be built first so that the entire area, back filled afterwards, is free from any obstacles. The small spring supported RC deck for the fan can be added at any convenient time later on.

Strict production methods in the manufacturing of the spring units and Viscodampers® combined with continuous quality control ensures that the life time of GERB vibration isolation systems is compatible to that of the whole plant.

Principle of Spring Support



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Spring Support of Fan Foundations
Reference List (Excerpt)

Country	Plant / Owner	Manufacturer	Spring Supported
Algeria	CHLEF Cement Plant	ABB Solyvent Ventec	1830
Austria	Riedersbach	Waagner-Biro	2400
Belgium	Ruien	KKK	5500
Bulgaria	Maritza East	Howden Power	8 x 2450
Canada	Ontario Hydro	TLT	790
China	Chongqing	Howden Variax	5530
	Chongqing-West	Shenyang Blowers	3100
	Laibin B Power Plant	Shanghai Blowers	4 x 1260
Czech Republic	Pocerady 6	TLT	4500
Denmark	Asnaes 5	Novenco	4700
Finland	Kristiina	Novenco	2550
France	Cordemais / EDF		6 x 6300
	Sollac Dunkerque	Quillery	3 x 4830
Germany	Berrenrath	App. Rothemühle	2 x 2500
	MVA Flingern	ABB Solyvent-Ventec	3 x 1200
	Kaiserstuhl	Venti Oelde	6130
	Mittelsbüren	Reitz	1200
	München Nord	KKK	1810
	Neurath	TLT	5530 + 8020
	Niederaussem	Voith Howden	2640
	Offleben B	BKB Helmstedt	5610
	Schwarze Pumpe	Voith	4 x 3210
Great Britain	Cottam	TLT	4 x 6300
Greece	Aghios Dimitrios	KKK	5300
India	Bakreshwar / WBPDCL	BHEL	6 x 3500
	Dadri / NTPC	BHEL	8 x 3500 + 16 x 1000
	Dahanu / BSES	BHEL	4 x 3500
	Khaparkheda / MSEB	BHEL	4 x 3500 + 12 x 800
	Neyveli Zero Unit	TLT	4 x 3500
	Panipat/HPGCL	BHEL	6 x 3500
	Ramagundam/NTPC	BHEL	2 x 6750 + 4 x 1200
	Unchahar / NTPC	BHEL	12 x 3500
	Vindhyachal / NTPC	BHEL	4 x 6750
Indonesia	Krakatau Steel	TLT	3590
Italy	Ital Impianti	Howden	3 x 2120
Marocco	Jorf Lasfar Power Plant	ABB	2 x 1800
Mexico	Truko	App. Rothemühle	
Netherlands	AVI Roteb	App. Rothemühle	4 x 1530
Poland	Jaworzno III	KKK	4 x 5770
Romania	Turceni	TLT	4 x 1260
Russia	MSZ3 Moscow	TLT	2 x 710
Sweden	Malmö	Rotamill	
Slowenia	Sostanj	Howden	2 x 4050
South Africa	ERGO I	KKK	790
Spain	Aceralia / Aviles	TLT	2 x1500
	El Alto Cement Plant	ABB Solyvent Ventec	2 x 1800
Taiwan	Vanguard	Meissner & Wurst	
Thailand	Mae Moh Power Plant	Howden Variax	2 x 3320
Turkey	Canakkale Cement	Baytur	2000
USA	Lehigh Portland Cement	Venti Oelde	3400

Spring supported Fans

GERB
worldwide

For the design of elastic support systems of fans please provide the following data:

- Type and manufacturer of fan
- Arrangement drawing
- Total weight of fan
- Center of gravity (if available)
- Speed or speed range of fan
- Any additional information (like earthquake risk)

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