

Renewable Energy through Product Innovation

One of the most efficient forms of renewable energy is hydro-electricity. A typical hydropower plant will produce electricity by the use of hydro-electric generators. Problems often arise with these generators over time due to high frequency vibrations excited by periodic and stochastic forces originating in the hydraulic machines and generator. Usually the vibration peaks out at the guiding bearing above the generator rotor, causing substantial damage to the generator and surrounding structure.

Enidine has developed the new Visco-Elastic Support (VES) product line to provide improved dynamic behavior of the rotor-bearing system and thermal force reduction to bearing support structures. The working principle of VES is by providing high dynamic stiffness, adding supplementary damping to the rotor-bearing system, low static stiffness for thermal movement. This reduces dynamic response of the generator, prevents the transfer of excessive thermal forces to the civil structure, thereby extending the life of the generator, structure and increases the output efficiency of the power plant.



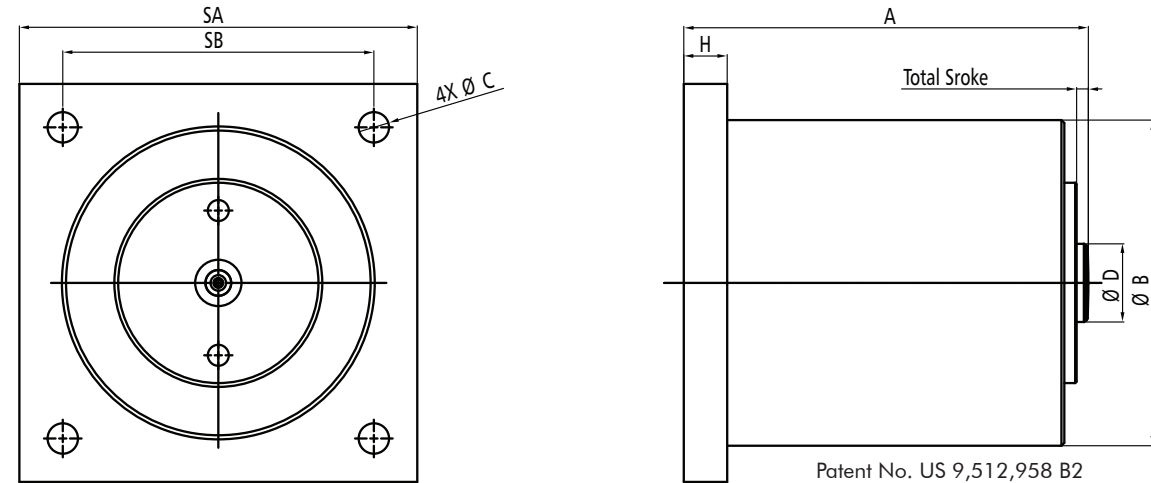
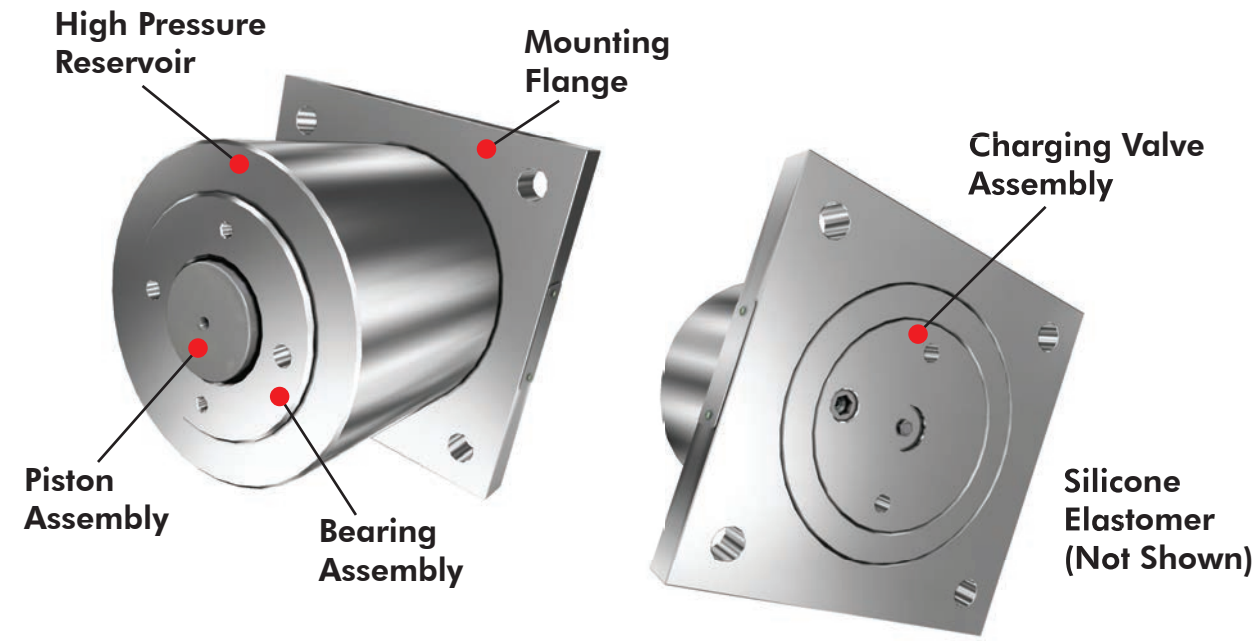
Visco-Elastic Support (VES)



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Visco-Elastic Support (VES) Products

VESXD: Visco Elastic Support with eXtra Dynamic stiffness



Dimensional Data

Model	A Fully Extended mm	B mm	D mm	Flange ⁽⁶⁾			
				SA mm	SB ⁽⁷⁾ mm	H mm	C mm
VESXD***A	205 ⁽⁸⁾	165	50	205.0	155	25.0	21.5
VESXD***B	223.5 ⁽⁸⁾	180	60	220.0	170	25.0	21.5
VESXD***C	223.5 ⁽⁸⁾	203	70	235.0	185	30.0	21.5
VESXD***D	231.5 ⁽⁸⁾	227	80	260.0	210	30.0	21.5
VESXD***E	241.5 ⁽⁸⁾	255	90	290.0	240	30.0	21.5

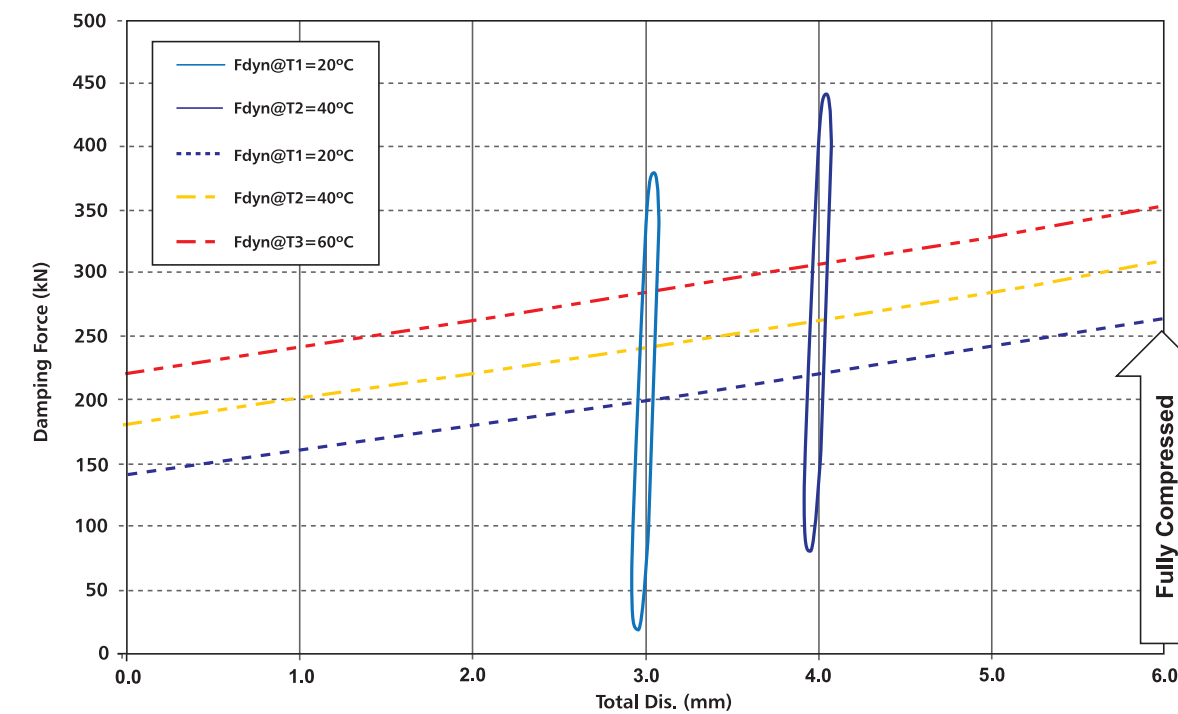
- Note: 6. Default shape of flange is square, Consult Enidine for other custom flange options.
 7. Bolt hole space SB can be adjusted up to 20mm more from listed value.
 Consult Enidine for other custom dimensions.
 8. Nominal length. Verify with Enidine before ordering.
 Consult Enidine for other custom length.

Dynamic Properties

Model	S _{max} Total Stroke mm	Set Point		F ₁ Preload at Set Point S ₁ @20°C kN	F ₂ Preload at Set Point S ₂ @40°C kN	F _D Maximum Damping Force kN	RDY1 Dynamic Stiffness at 20°C kN/mm	RDY2 Dynamic Stiffness at 40°C kN/mm	RST Static Stiffness kN/mm	RSTV Thermal Static Stiffness kN/mm
		S ₁ @20°C mm	S ₂ @40°C mm							
VESXD80A	6 ⁽¹⁾	HV1 ⁽²⁾	4	80	FV2 ⁽²⁾	<70	RDY1 ⁽³⁾	~1800 ⁽⁴⁾	~6.4 ⁽⁵⁾	~24.0 ⁽⁵⁾
VESXD100A	6 ⁽¹⁾	HV1 ⁽²⁾	4	100	FV2 ⁽²⁾	<90	RDY1 ⁽³⁾	~1850 ⁽⁴⁾	~10.0 ⁽⁵⁾	~32.2 ⁽⁵⁾
VESXD100B	6 ⁽¹⁾	HV1 ⁽²⁾	4	100	FV2 ⁽²⁾	<90	RDY1 ⁽³⁾	~2150 ⁽⁴⁾	~7.9 ⁽⁵⁾	~29.5 ⁽⁵⁾
VESXD150B	6 ⁽¹⁾	HV1 ⁽²⁾	4	150	FV2 ⁽²⁾	<135	RDY1 ⁽³⁾	~2250 ⁽⁴⁾	~16.3 ⁽⁵⁾	~47.7 ⁽⁵⁾
VESXD150C	6 ⁽¹⁾	HV1 ⁽²⁾	4	150	FV2 ⁽²⁾	<135	RDY1 ⁽³⁾	~2850 ⁽⁴⁾	~15.4 ⁽⁵⁾	~47.7 ⁽⁵⁾
VESXD200C	6 ⁽¹⁾	HV1 ⁽²⁾	4	200	FV2 ⁽²⁾	<180	RDY1 ⁽³⁾	~3000 ⁽⁴⁾	~22.6 ⁽⁵⁾	~62.6 ⁽⁵⁾
VESXD150D	6 ⁽¹⁾	HV1 ⁽²⁾	4	150	FV2 ⁽²⁾	<135	RDY1 ⁽³⁾	~3750 ⁽⁴⁾	~12.0 ⁽⁵⁾	~44.2 ⁽⁵⁾
VESXD200D	6 ⁽¹⁾	HV1 ⁽²⁾	4	200	FV2 ⁽²⁾	<180	RDY1 ⁽³⁾	~3850 ⁽⁴⁾	~20.9 ⁽⁵⁾	~63.9 ⁽⁵⁾
VESXD250D	6 ⁽¹⁾	HV1 ⁽²⁾	4	250	FV2 ⁽²⁾	<225	RDY1 ⁽³⁾	~3950 ⁽⁴⁾	~29.2 ⁽⁵⁾	~80.5 ⁽⁵⁾
VESXD250E	6 ⁽¹⁾	HV1 ⁽²⁾	4	250	FV2 ⁽²⁾	<225	RDY1 ⁽³⁾	~5000 ⁽⁴⁾	~25.3 ⁽⁵⁾	~77.5 ⁽⁵⁾
VESXD300E	6 ⁽¹⁾	HV1 ⁽²⁾	4	300	FV2 ⁽²⁾	<270	RDY1 ⁽³⁾	~5000 ⁽⁴⁾	~37.3 ⁽⁵⁾	~101.0 ⁽⁵⁾

- Note: 1. Default total stroke is 6mm, Consult Enidine for other custom total stroke lengths.
 2. Stroke At Preload at 20°C is application specific. HV1=4mm – HTH_T2(Thermal Expansion Stroke @T2). FV2, Preload at 40°C is also application specific.
 3. Dynamic Stiffness at 20°C, RDY1, is function of HV1 and F1. Typically it's approximately 10% lower than RDY2.
 4. Dynamic Stiffness at 40°C, RDY2, is function of VESXD overall size.
 5. Static Stiffness and Thermal Static Stiffness, RST and RSTV, are function of HV1 and F1.

VESXD 200D Theoretical Performance Specification (Sample)



VES Technology

- Viscoelastic supports utilize the fluid properties of a viscoelastic “putty” to produce a desired force, displacement, and velocity relationships.
- High dynamic stiffness to reduce vibration.
- Low static stiffness to accommodate thermal expansion of supporting structural members.
- Installed in the preloaded condition to prevent tensile forces to the support structures.