

Vertical Bearings

AV, LV & V Series



**Michell
Bearings**



About Us

As the inventor of the hydrodynamic bearing over 100 years ago, Michell Bearings has continued to develop its products to meet the changing needs of industry.

The company's in-house design engineers work alongside its specialist manufacturing team in the UK to provide customers with high quality, innovative hydrodynamic white metal and PTFE lined bearings serving a range of industrial, commercial marine and naval markets.

In order to support critical applications in industries where products are required to meet stringent specifications and perform in demanding environments, Michell Bearings has developed a range of unique performance software tailored to its products. This provides more accurate and reliable performance predictions than with any other commercially available software. Results from the software, which are backed up by years of product research and development testing, give customers peace of mind and confidence in Michell Bearings ability to deliver safe and reliable bearing solutions.

Our product range includes:

- Vertical Guide Bearings (V)
- Advanced Vertical Thrust and Guide Bearings (AV)
- Large Vertical Thrust and Guide Bearings (LV)
- Thrust Bearings for marine applications
- Industrial Horizontal Bearings (IH)
- Heavy Duty Thrust Bearings (HD)
- Marine Propeller Shaft Bearings (MA & MT)
- Self-aligning Pedestal Bearings (NSA)
- Omega Thrust Rings
- Omega Equalised Thrust Rings
- Journal Pad Units
- Special designs to individual customer specification

Quality

- The quality system operated at Michell Bearings for design and support of our products is approved to BS EN ISO 9001:2008
- Our management system has been certified to the health, safety and environmental standard ISO14001:2004
- Michell Bearings also complies with the occupational health and safety standard OHSAS 18001:2007.

For special applications, and where the preference is for the bearing internals to be positioned within the casing of the machine, Michell Bearings can offer bespoke bearing internal solutions and special self-contained bearing designs.

Basic information required at enquiry stage:

- Project details
- Quantity of bearings
- Shaft diameter
- Axial loading data including shaft rotor weight
- Radial loading data
- Speed ranges, directions and durations
- Preferred cooling type
- Preferred oil type
- Water/oil inlet temperature

Technical Features of Vertical Bearings

Application of polytetrafluoroethylene (PTFE) material for AV and LV ranges

- Michell Bearings introduced PTFE lined bearing designs into its portfolio of products in 1995
- Since then the company has built up a sizeable reference list covering a wide variety of rotating machine applications
- The AV10 bearing and sizes upward, and also the complete LV range, can be supplied with PTFE lined thrust pads, allowing the bearing to operate with increased axial thrust capacity when compared with whitmetal pads
- The increased thrust capacity of PTFE bearings can allow a smaller bearing frame size to be used and therefore lower power losses due to reduced sliding speeds on smaller diameters
- The use of PTFE can also eliminate the need for high pressure oil lift (jacking) in the lower thrust face
- Both of these points can have considerable cost benefits for both the OEM and the end user

Cooling

The Vertical Bearing range offers three types of cooling methods:

- Water cooling using high performance cooling coils available in cupro nickel, stainless steel or titanium
- Circulating oil using an external lubrication system

For the AV and V Series only

- Where conditions allow, air cooling can be considered, either natural air or fan cooled

The choice depends on a number of factors, such as water availability at site, water composition, operational duty and specification requirements.

Instrumentation

All instrumentation can be physically supplied or provision made in the design and can either be compliant to end user specification or our own standard design. Examples include:

- Temperature measurement – oil bath and whitmetal surfaces using a combination of the following methods:
 - Dial type thermometer for local measurement
 - Resistance temperature detector (RTD) or thermocouples for remote measurement
- Use of thermowells to facilitate the replacement of instruments without the need to dismantle the bearing
- Provision for vibration or shaft displacement measurement
- Oil level float switches for monitoring the bearing oil level

Insulation

- Michell Bearings standard method of electrically insulating bearings is to insulate the baseplate, cooling connections and instrumentation.

If there is a special requirement, the bearings can also be insulated at the thrust collar (AV and LV Series only).

Sealing

The Vertical Bearing range can be provided with sealing suitable for prevention against the ingress of water, dust or foreign particles, to meet IP ratings and therefore making them suitable for outdoor applications.

There are various options available including:

- A flinger and a felt dust seal arrangement can be fitted to the top and bottom of the bearing to give protection against the ingress of foreign matter
- Rubber lipped oil seals can also be fitted
- Where suction pressures at the machine side of the bearing are high, a separate seal assembly for pressure compensation is used

Load carrying components

- Downward thrust loads are normally supported with offset pivoted whitmetal (babbitt) lined thrust pads positioned below the bearing thrust collar for a principal direction of rotation
- For bi-directional operation, centre pivoted whitmetal (babbitt) lined thrust pads are used
- Radial loads are supported on eight centre pivoted whitmetal (babbitt) lined journal (guide) pads

Non-standard features

- Mechanical load equalisation of the lower thrust face
- Load measurement using load cells
- Any other customer or specification specific requirements

Technical documentation

With every order Michell Bearings will provide:

- A detailed arrangement drawing
- An Operating and Maintenance Instruction Manual
- A comprehensive bearing performance prediction including:
 - Oil viscosity grade
 - Thrust and journal pad geometry
 - Minimum oil film thickness
 - Maximum pad operating temperatures
 - Power losses
 - Bearing oil bath temperature
 - Cooling requirement

Overview of Vertical Bearings

Michell Bearings' vertical bearings (AV, LV and V Series) have been designed and developed as fully self-contained, general purpose, modular assemblies to meet customer's requirements.

Applications

Typical applications for vertical bearings include:

- Vertical pumps
- Vertical motors and generators
- Hydro applications

Common end user applications include:

- Nuclear power generation
- Fossil power generation
- Hydro power generation
- Desalination
- Irrigation
- Oil and gas industry



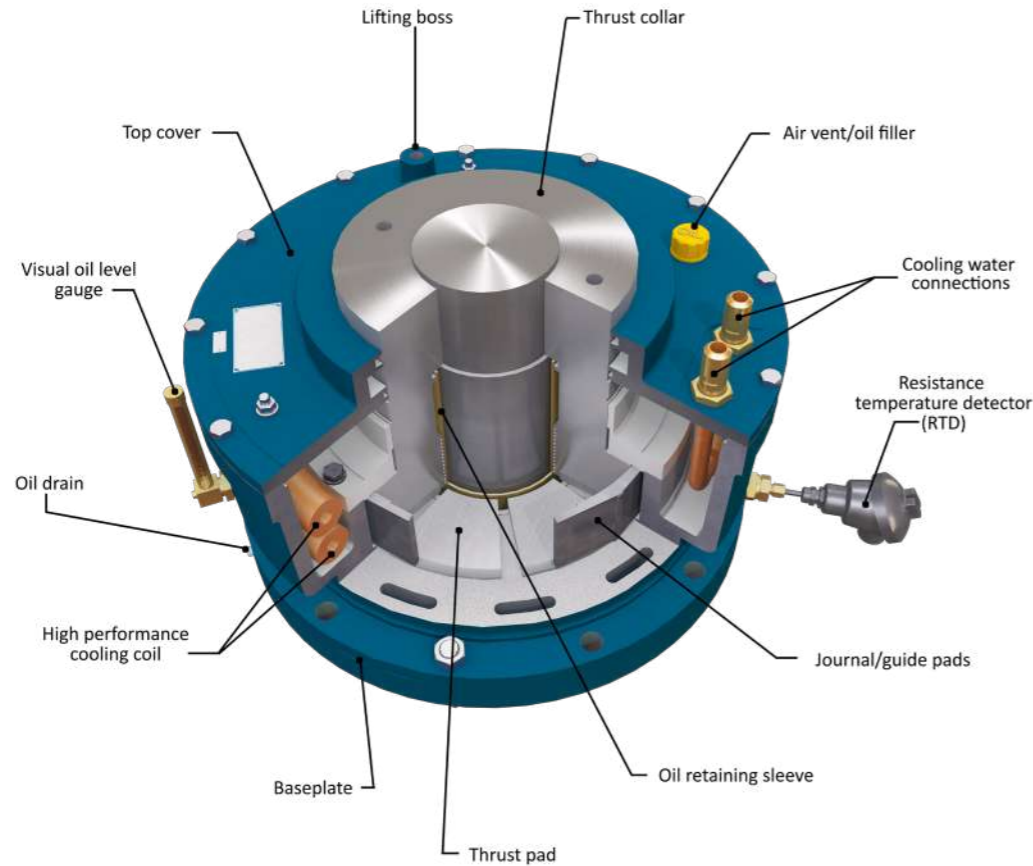
Advanced Vertical (AV) Bearings

Overview of the AV Bearing

The Michell Bearings Advanced Vertical Bearing, known as the AV Series, has been designed and developed as a self-contained, general purpose, standard assembly range of vertical thrust and guide bearings. This standard economic range has been designed to meet the requirements of original equipment manufacturers (OEM).

Key features:

- Nine bearings frame sizes
- Shaft diameter range of 68mm to 411mm
- Axial load capability up to 738kN
- Three standard configurations of shaft diameters (N, L and XL) are available in each frame size, which allows the most compact and cost effective bearing to be selected for a given shaft diameter
- Available with water cooling, circulating oil cooling or fan/air cooling



Selection Criteria

Selecting one option from the following headings will provide Michell Bearings with an understanding of the product you require. However, we are more than happy to work with you on creating a bespoke product to meet your needs; if this is the case please contact us.

Type of bearing

AV (advanced vertical)

Frame size

From 6 to 14

Thrust surface

- S – single thrust face for downward thrust loads only
- D – double thrust face for axial loads in either direction
- B – single downward thrust with an upward plain whitemetal location face for upward transient loads

Shaft details

- N – normal
- L – large
- XL – extra large

Cooling

- T – water cooled (number of tubes)
- C – circulating oil
- F – fan cooled

Example:

An AV with frame size 12 with a single thrust face, normal shaft and water cooled – **AV12 SNT3**

Technical Information

AV Series Capacity

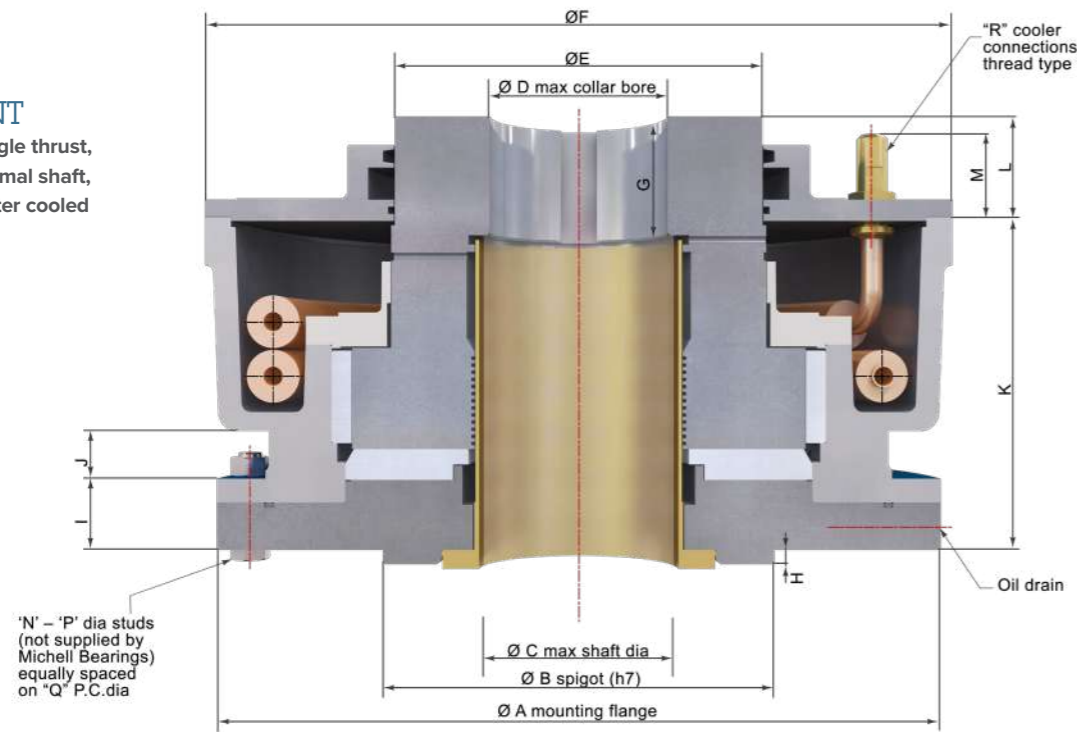
FRAME SIZE	Shaft Variant	Max Stepped Shaft Diameter (1)	Max Straight / Un-stepped Shaft Diameter (1)	Downward Max Running Thrust Load (2)	Downward Max Starting Thrust Load (3)	Downward Max Closed Valve Thrust Load (4)	Max Radial Load (5)	Upward Max Starting Thrust Load D only (6)	Upward Max Running Thrust Load D only (6)	Upward Max Starting Thrust Load B only (6)	Upward Max Running Thrust Load B only (6)	Upward Transient Thrust Load (<=10 secs) B Only (6)
		mm	mm	kN	kN	kN	kN	kN	kN	kN	kN	kN
AV6	SN/BN/DN	68	65	42.3	29	66.8	5.5	16.1	18.7	3.8	6	10.5
	SL/BL	89	84	32.9	22.5	42.1	5.5	-	-	2.6	4.2	7.4
	SXL	105	97	20.2	17.3	32.3	5.5	-	-	-	-	-
AV7	SN/BN/DN	78	74	62	42.5	97.7	7.4	20	29.1	5.5	8.9	15.6
	SL/BL	107	100	46.9	32.1	60	7.4	-	-	3.9	6.2	10.9
	SXL	126	119	28.9	24.8	46.2	7.4	-	-	-	-	-
AV8	SN/BN/DN	90	86	96.9	55.2	127.3	9.8	32.3	47.1	7.5	12	21
	SL/BL	131	124	56.1	38.4	71.8	9.8	-	-	4.5	7.2	12.6
	SXL	153	146	39.8	28.1	52.6	9.8	-	-	-	-	-
AV9	SN/BN/DN	115	109	155.3	88.8	204.1	15.6	44.5	76.8	12.4	19.9	34.8
	SL/BL	160	150	115.2	65.9	151.5	15.6	-	-	8.4	13.4	23.5
	SXL	187	176	88.9	50.8	94.8	15.6	-	-	-	-	-
AV10	SN/BN/DN	142	137	214.8	122.8	282.3	21.7	54.9	94.6	8.8	14.1	24.7
	SL/BL	190	180	163.2	93.2	214.5	21.7	-	-	8.8	14.1	24.7
	SXL/BXL	222	213	126.1	72	165.7	21.7	-	-	8.8	14.1	24.7
AV11	SN/BN/DN	165	156	308.8	173.5	399.2	29.3	86.5	149.1	12.7	20.3	35.5
	SL/BL	225	217	228.5	130.6	300.3	29.3	-	-	12.7	20.3	35.5
	SXL/BXL	263	247	176.6	100.9	232.1	29.3	-	-	12.7	20.3	35.5
AV12	SN/BN/DN	192	187	392.2	224.2	515.6	39.5	107.5	185.4	17.3	27.7	48.5
	SL/BL	256	244	299.2	171	393.2	39.5	-	-	17.3	27.7	48.5
	SXL/BXL	300	288	230.1	131.5	302.5	39.5	-	-	17.3	27.7	48.5
AV13	SN/BN/DN	216	212	518.1	296.1	680.9	48.2	142.6	245.9	23	36.8	64.4
	SL/BL	293	282	391.3	223.6	514.2	48.2	-	-	23	36.8	64.4
	SXL/BXL	343	333	301.8	172.4	396.6	48.2	-	-	23	36.8	64.4
AV14	SN/BN/DN	256	246	738.6	422	970.7	73	172.6	297.7	33.2	53.1	92.9
	SL/BL	352	343	551.5	315.2	724.9	73	-	-	33.2	53.1	92.9
	SXL/BXL	411	396	425.8	243.3	559.6	73	-	-	33.2	53.1	92.9

Notes:

- 1 - For straight through unstepped shafts the maximum shaft diameter should be taken from Column 'D'
- 2 - Higher thrust loads can be accommodated. Please consult Michell Bearings for requirements such as API 610
- 3 - High pressure lift (jacking) for whitemetal pads or PTFE can be provided for applications with starting loads higher than those in Column 'F'
- 4 - Maximum closed valve loads are for guidance only and should be confirmed by Michell Bearings
- 5 - Maximum radial load will vary, depending upon speed and oil viscosity
- 6 - Upper thrust load can only be accommodated on bearings with optional surge or upper thrust face
- 7 - The maximum speed varies with running thrust load, the grade of oil used and the water inlet temperature
- 8 - All loads are based on whitemetal surfaced pads.

Technical Information

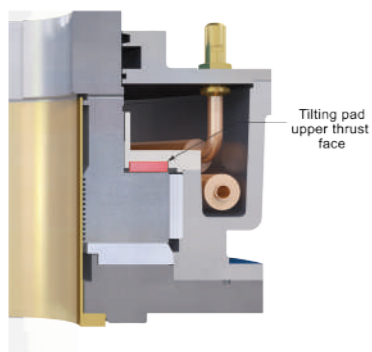
SNT
Single thrust, normal shaft, water cooled



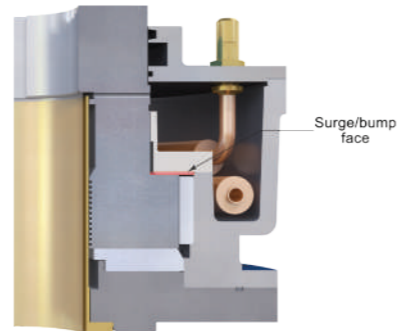
AV Series Dimensions

Frame Size	A	FORN FRAME SIZES B	FORL & XL FRAME SIZES B	MAX SHAFT DIA FOR N C	MAX SHAFT DIA FOR L C	MAX SHAFT DIA FOR XL C	MAX COLLAR BORE FOR N D	MAX COLLAR BORE FOR L D	MAX COLLAR BORE FOR XL D	FOR SNT, SLT, SXLT E	FOR BNT E	FOR BLT E	FOR DNT E	F	G	H	I	J	K	FOR 2 POLE SPEEDS K	L	M	FOR T2 & T3 Coolers M	N	P	Q	R
AV6	310	140.0	169.0	68	89	105	65	84	97	133	103	118	105	330	47	8	30	28	141	174	42	71	51	8	12	279.5	1/2" BSP
AV7	358	165.1	191.0	78	107	126	74	100	119	159	121	141	133	375	49	8	35	34	157	196	45	71	51	10	16	324	1/2" BSP
AV8	418	190.5	220.0	90	131	153	86	124	146	183	134	163	137	435	55	8	38	32	182	228	50	86	61	10	16	380	3/4" BSP
AV9	460	228.6	256.0	115	160	187	109	150	176	227	170	202	186	476	64	12	41	34	210	-	54	71	51	10	20	425.5	1/2" BSP
AV10	552	279.4	309.9	142	190	222	137	180	213	261	261	261	235	575	80	12	50	40	245	-	70	86	61	12	20	508	3/4" BSP
AV11	610	330.0	355.9	165	225	263	156	217	247	310	310	310	268	630	100	12	60	40	280	-	85	86	61	12	20	568	3/4" BSP
AV12	698	368.0	398.9	192	256	300	187	244	288	356	356	356	315	718	110	12	65	40	305	-	100	86	61	12	20	654	3/4" BSP
AV13	813	400.0	457.0	216	293	343	212	282	333	407	407	407	360	825	110	12	70	50	345	-	105	86	61	12	24	770	3/4" BSP
AV14	914	440.0	532.7	256	352	411	246	343	396	485	485	485	457	938	120	12	75	50	380	-	115	86	61	12	24	864	3/4" BSP

DNT
Double thrust, normal shaft, water cooled



BNT
Single thrust with upward location face, normal shaft, water cooled



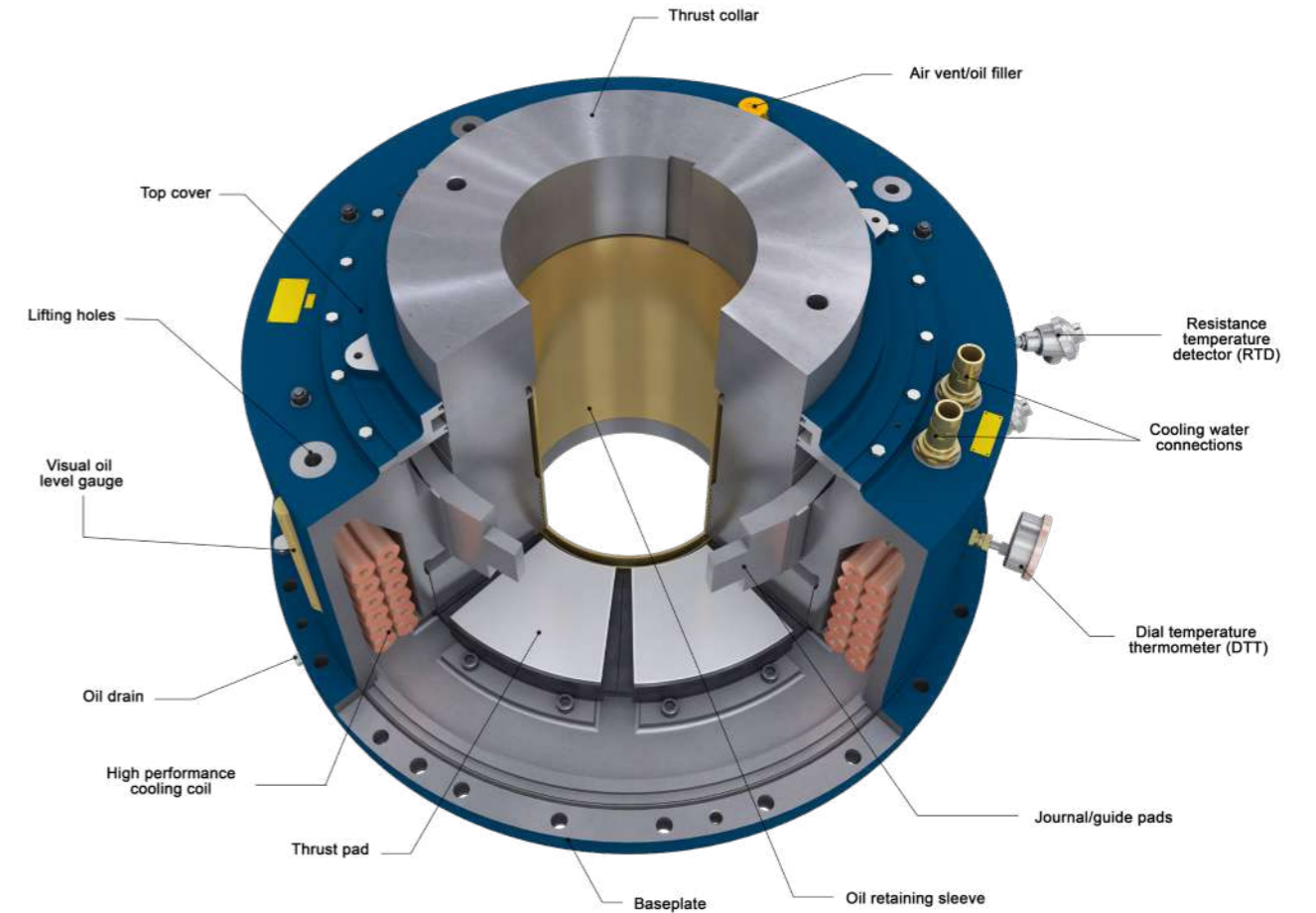
Large Vertical (LV) Bearings

Overview of the LV Bearing

The Michell Bearings Large Vertical Bearing, known as the LV Series, has been designed and developed as a fully self-contained, general purpose, standard assembly to meet customer's requirements. This series is a modular range of high capacity vertical shaft thrust and guide bearings, applicable where the thrust loads and shaft diameters exceed those covered by the Michell Bearings Advanced Vertical (AV) series.

Key features:

- Four bearing frame sizes
- Shaft diameter range from 300mm to 600mm
- Axial load capacity up to 2155kN
- Three standard configurations of shaft diameters (N, L and XL) are available in each frame size, which allows the most compact and cost effective bearing to be selected for a given shaft diameter
- Available with water cooling or circulating oil cooling



Selection Criteria

Selecting one option from the following headings will provide Michell Bearings with an understanding of the product you require. However, we are more than happy to work with you on creating a bespoke product to meet your needs; if this is the case please contact us.

Type of bearing

LV (large vertical)

Frame size

From 1 to 4

Thrust surface

S – single thrust face for downward thrust loads only
 D – double thrust face for axial loads in either direction
 B – single downward thrust with an upward thrust face for upward transient loads

Shaft details

N – normal
 L – large
 XL – extra large

Cooling

T – water cooled (number of tubes)
 C – circulating oil

Example:

An LV with frame size 1 with a single thrust face, normal shaft and water cooled – LV1SNT2

Technical Information

LV Series Capacity

A	B	C	D	E	F	G	H	I	J	K	L	M
FRAME SIZE	Shaft Variant	Max Shaft Diameter (1)	Max Collar Bore for Unstepped Shafts (1)	Max Thrust Load Normal Duty (2)	Max Starting Thrust Load without High Pressure Jacking (3)	Max Closed Valve Thrust Load (4)	Approximate Max Radial Load (5)	Max Running Thrust Load D only (6)	Max Starting Thrust Load D only (6)	Max Running Thrust Load B only (6)	Transient Thrust Load B Only (Duration <10 secs) (6)	Approx Max Speed for Water Cooled Option (7)
		mm	mm	kN	kN	kN	kN	kN	kN	kN	kN	RPM
LV1	N	300	299	1020	583	1339	102	250	143	43	75	750
	L	353	346	900	514	1182	102	250	143	43	75	750
	XL	395	388	800	457	1050	102	250	143	43	75	750
LV2	N	353	341	1335	763	1753	133.5	340	194	68	118	700
	L	415	404	1170	669	1536	133.5	340	194	68	118	700
	XL	463	452	1045	597	1372	133.5	340	194	68	118	700
LV3	N	404	396	1730	989	2272	173	410	234	80	140	650
	L	475	467	1519	868	1995	173	410	234	80	140	650
	XL	530	523	1352	773	1775	173	410	234	80	140	650
LV4	N	452	447	2155	1231	2830	215.5	575	329	122	215	550
	L	547	544	1830	1046	2403	215.5	575	329	122	215	550
	XL	600	597	1600	914	2101	215.5	575	329	122	215	550

Notes:

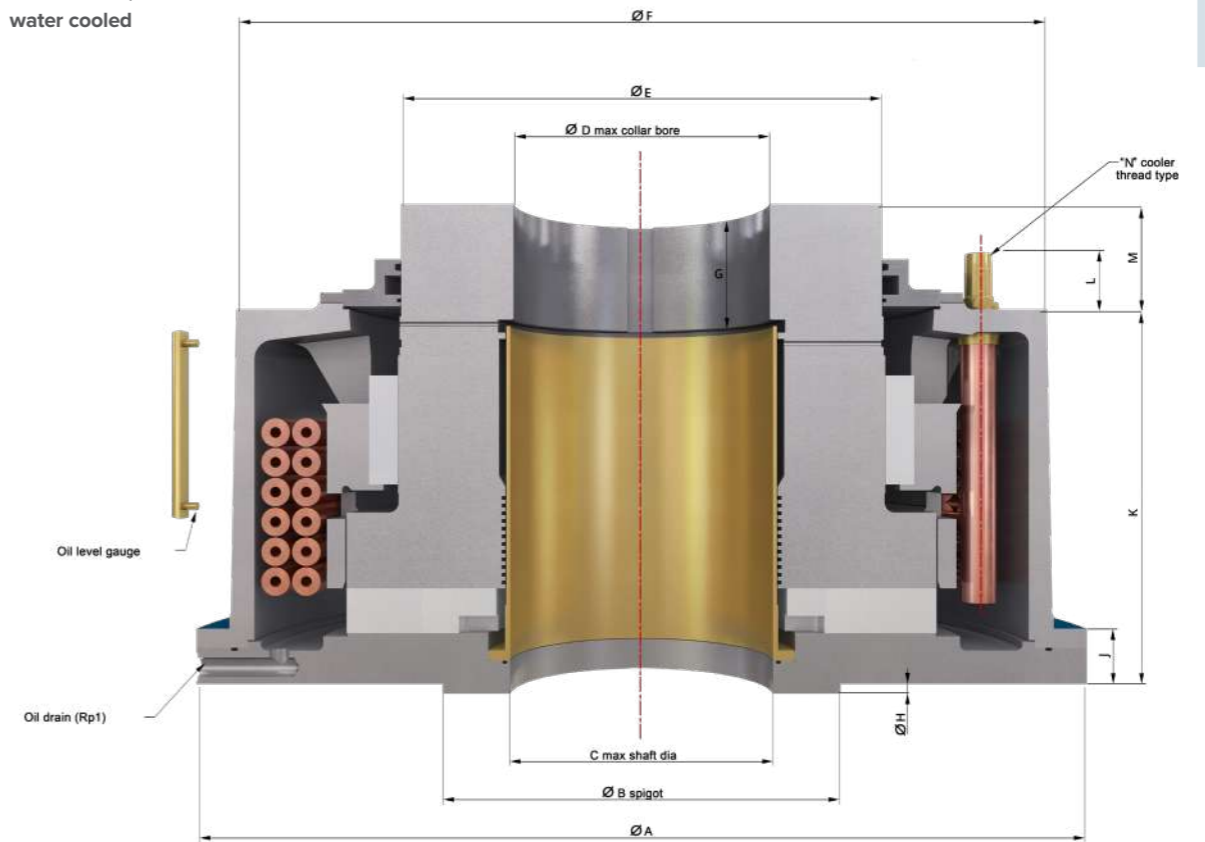
- 1 - For straight through unstepped shafts the maximum shaft diameter should be taken from column D
- 2 - Higher thrust loads can be accommodated, please consult Michell Bearings for requirements such as API 610
- 3 - High pressure lift (jacking) for whitmetal pads or PTFE can be provided for applications with starting loads higher than those in Column 'F'
- 4 - Maximum closed valve loads are for guidance only and should be confirmed by Michell Bearings
- 5 - Maximum radial load will vary, depending upon speed and oil viscosity
- 6 - Upper thrust load can only be accommodated on bearings with optional surge or upper thrust face
- 7 - The maximum speed varies with running thrust load, the grade of oil used and the water inlet temperature
- 8 - All loads are based on whitmetal surfaced pads



Technical Information

SNT

Single thrust, normal shaft, water cooled



LV Series Dimensions

Frame Size	ØA	ØB			ØC MAX (*)			ØD MAX (*)			ØE	ØF	G	H	J	K	L	M	N	Q	R	S	T
		N	L	XL	N	L	XL	N	L	XL													
LV1	1162	500	553	595	300	363	395	299	346	388	560	1040	150	15	78	458	96	133	G-1/2"	16	1110	120	450
LV2	1274	548	610	658	353	415	463	341	404	452	625	1150	160	15	82	522	96	140	G-1/2"	18	1222	120	495
LV3	1388	606	677	732	404	475	530	396	467	523	750	1264	180	15	86	594	96	154	G-1/2"	24	1336	120	543
LV4	1600	720	775	838	452	547	600	447	544	597	820	1420	180	15	101	615	96	182	G-1/2"	24	1535	120	610

Q off Ø 28 holes equi-spaced on 'R' PCD for M24 fasteners

S = Distance between the centres of the inlet & outlet water connections

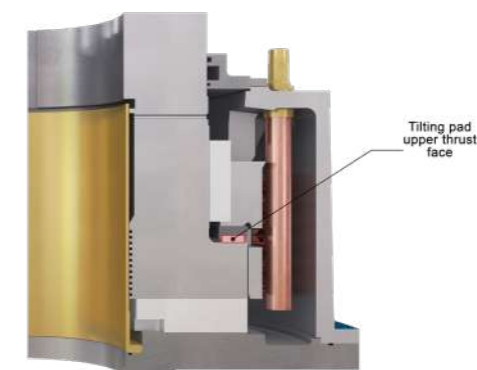
T = Distance from the centre line of the bearing to the centre line of the water connections

(*) ØC MAX = maximum shaft diameter for stepped shafts

(*) ØD MAX = maximum shaft diameter for straight/unstepped shafts

DNT/BNT

Double thrust, normal shaft, water cooled for transient (BNT) or continuous (DNT) upward thrust loads



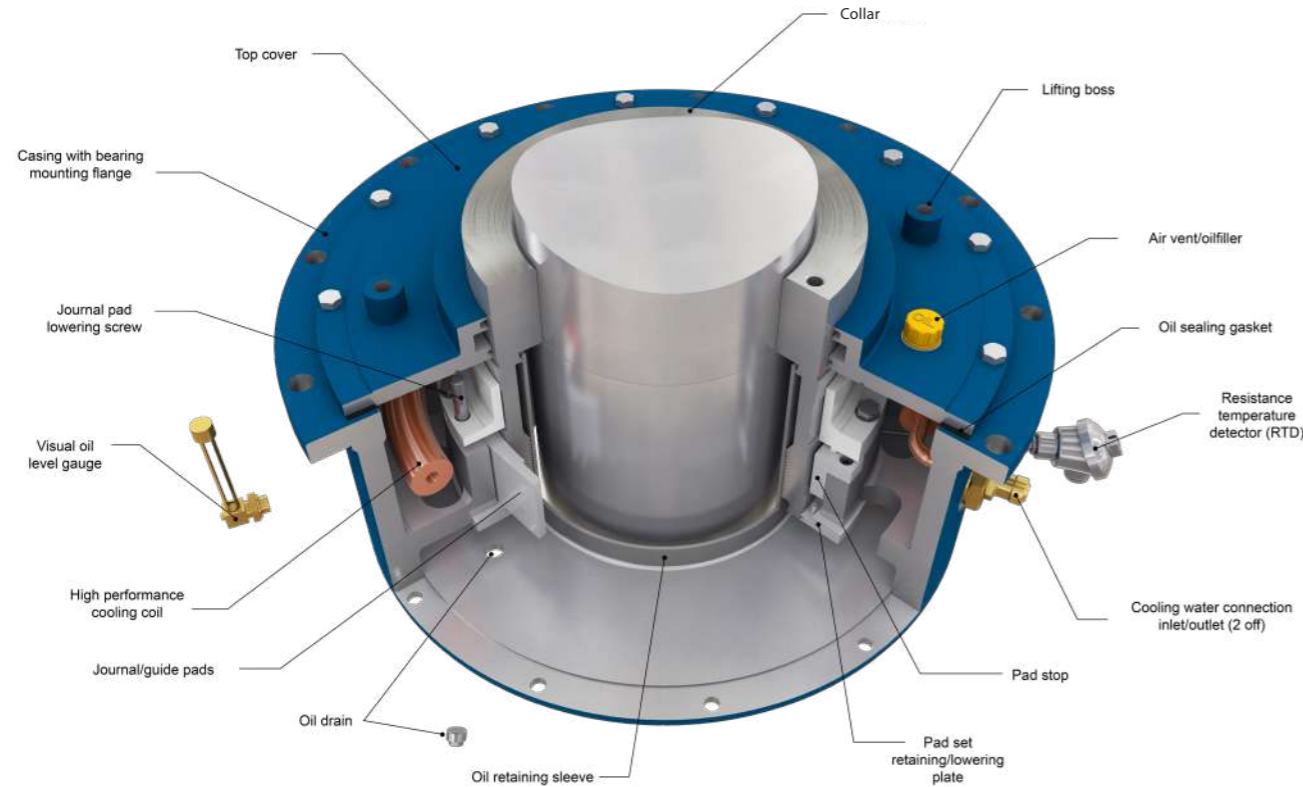
Vertical (V) Guide Bearings

Overview of the V Guide Bearing

The Michell Bearings Vertical Guide Bearing, known as the V Series, has been designed and developed as a fully self-contained, general purpose, standard assembly range of vertical guide bearings. This standard economic range has been designed to meet the requirements of original equipment manufacturers (OEM).

Key features:

- Ten bearing frame sizes
- Shaft diameter range of 96mm to 480mm
- Radial load capacity up to 68kN
- Available with water cooling, circulating oil cooling or air cooling



Selection Criteria

Selecting one option from the following headings will provide Michell Bearings with an understanding of the product you require. However, we are more than happy to work with you on creating a bespoke product to meet your needs; if this is the case, please contact us.

Type of bearing

G (Vertical Guide)

Example:

V with frame size 11 arranged for air cooling – 11GA

Frame size

From 5 to 14

Cooling

T – water cooled (number of tubes)

C – circulating oil

A – air cooled

Technical Information

V Series Capacity

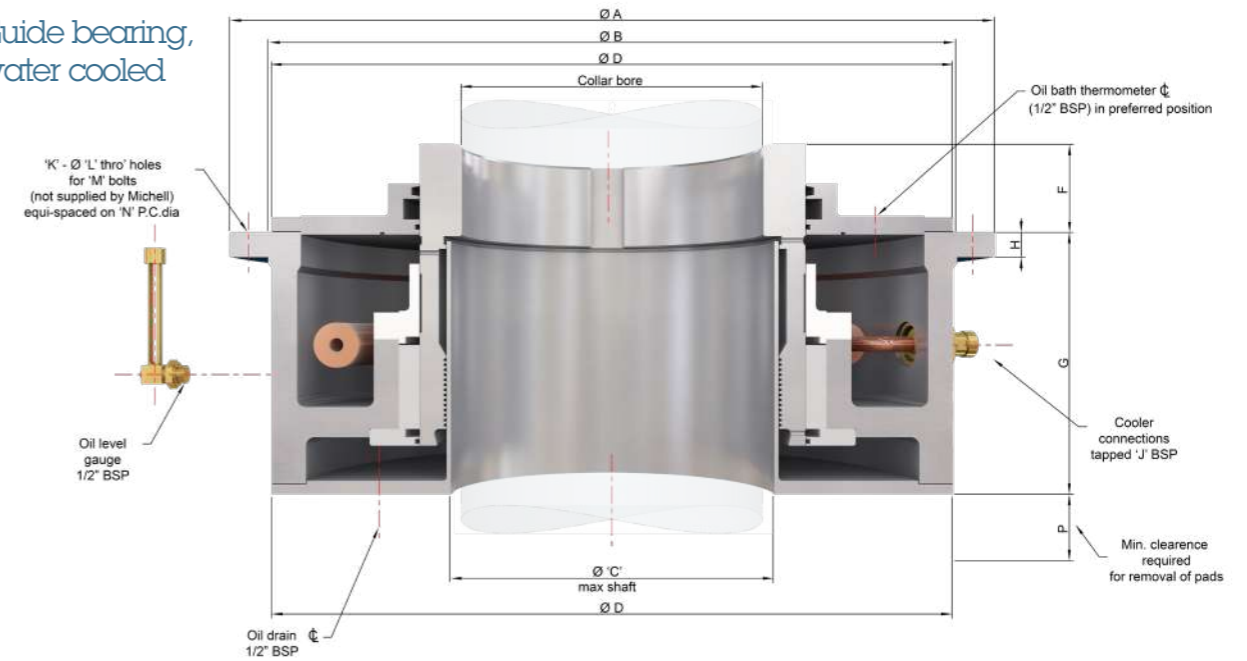
STANDARD FRAME SIZE	Mean Surface Projected (mm ²)	Maximum Radial *Load kN	Journal Axial Length (mm)	Nominal Diametric Clearance CD (mm)	Guide Bearing Max. Shaft/ Sleeve Dia. (mm)
5	2026	2,5	28.5	0,14	96
6	3030	3,8	35	0,15	120
7	4056	5,0	40	0,18	140
8	5345	9,2	46	0,20	160
9	8391	14,5	58	0,25	200
10	11814	20,4	68	0,30	250
11	15817	27,3	78	0,35	280
12	21328	36,8	95	0,40	320
13	25878	44,3	100	0,45	380
14	39445	68,0	125	0,55	480

Number of journal pads/bearing = 8 | Whitemetal angle (β) = 26°

Notes:

* The maximum radial load can vary, and is dependent upon the viscosity of oil used in the bearing and the speed of the rotating collar journal. Therefore the above figures are for your guidance only - based on a unit load of 1723 kN/m² (250 lbs/in²)

Guide bearing, water cooled



N.B side entry cooler illustrated; however, if required, a top entry cooler can be supplied.

V Series Dimensions

STD NO.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	
5	340	-0.0 -0.043	279	96	273	42	36	122	15	1/2" BSP	10	15	M12	310	80
6	376	-0.0 -0.046	316	120	310	47	42	132	15	1/2" BSP	10	15	M12	346	80
7	434	-0.0 -0.046	364	140	358	49	45	147	20	1/2" BSP	10	19	M16	400	80
8	470	-0.0 -0.056	396	160	390	55	50	170	20	1/2" BSP	12	19	M16	436	85
9	534	-0.0 -0.056	466	200	460	64	54	197	20	1/2" BSP	12	19	M16	500	90
10	642	-0.0 -0.056	558	250	552	80	70	227	25	3/4" BSP	12	24	M20	600	105
11	700	-0.0 -0.061	616	280	610	100	85	252	25	3/4" BSP	12	24	M20	658	115
12	788	-0.0 -0.066	704	320	698	110	100	272	25	3/4" BSP	12	24	M20	746	125
13	914	-0.0 -0.071	822	380	813	110	105	312	30	3/4" BSP	12	28	M24	868	135
14	1018	-0.0 -0.074	924	480	914	120	115	352	36	3/4" BSP	12	28	M24	972	165

Our Total Customer Support Model

The Michell Bearings customer support model ensures our customers have peace of mind throughout the lifetime of our products and the solutions we engineer for them.

We know that bearing failure is serious; that downtime is expensive and with this in mind, exacting maintenance and servicing is key. If the worst happens speed of response is critical to ensure repair of existing parts or availability of replacement and spare parts.

Our global network and 24 hour manufacturing capability ensures Michell Bearings can react quickly and efficiently to the requirements of our customers. We have the in-house technical expertise to undertake virtually any whitmetal bearing repair, whether on an original Michell Bearings product or any other manufacturer's product.

However, service is the key to preventing bearing failure. Our dedicated service team, all highly trained engineers, travel all over the world to carry out both installation and routine service work in both the marine and industrial sectors.

Michell Bearings offers tailored, structured maintenance programmes to ensure bearing reliability. Whether scheduled or unplanned our diagnostic and corrective maintenance is vital to the continued smooth running of your operations and the satisfaction of your customers.



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