DNV·GL

Certificate No:
TAS00000YS

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Gears

with type designation(s)
Planetary gear WD series

Issued to
Dinamic Oil S.p.A.
Bomporto MO, Italy

is found to comply with
DNV GL standard DNVGL-ST-0378 – Standard for offshore and platform lifting appliances
DNV GL standard DNVGL-ST-0377 – Standard for shipboard lifting appliances
IMO SOLAS 1974 as amended and the LSA Code

Application :

Planetary gear units for slewing and hoist application. Design Temperature, TD, according to above standard -20 degees Celsius

Issued at **Høvik** on **2019-03-26**

This Certificate is valid until **2024-03-25**.
DNV GL local station: **Venice**

Approval Engineer: **Harald Jensen**

for **DNV GL**
Digitally Signed By: Matteucci, Aldo

Location: DNV GL Høvik, Norway

Aldo Matteucci
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Planetary gear unit with 3 stages and rotating housing. If other output speed is required, the number of hours is to be interpolated. Load spectrum and class of utilisation (based on principles according to F.E.M. 1.001 3rd edition) are defined below.
Loadspectrum Class L2 – Class of utilisation T5

Definition of load spectrum

Class	Load in % of max	Fraction in % of total time	Km
L1	100	3	0.125
	60	10	
	50	52	
	29	35	
L2	100	2	0.196
	60	65	
	50	59	
	40	10	
L3	100	25	0.613
	80	33	
	68	30	
	5	12	
L4	100	100	1

Classes of utilization

Class	T0	T1	T2	T3	T4	T5	T6	T7	T8
Hours	200	400	800	1600	3200	6300	12500	25000	50000

Max allowable torques for L2-T5 for the 3 staged series:

SIZE	STAGE 1	STAGE 2	STAGE 3	RATIO	L2 -T5 FEM TORQUE at 15 rpm [Nm]	MAX STATIC TORQUE [Nm]	SOLAS TORQUE [Nm]
WD 1000	RE 1020 (4,153)	RE 510 (3,60)	RE 310 (3,6)	52,82	15450	26900	9900
	RE 1020 (4,153)	RE 510 (4,25)	RE 310 (3,6)	62,54	15450	26900	9900
	RE 1020 (4,153)	RE 510 (4,25)	RE 310 (4,25)	74,01	15450	26900	9900
	RE 1020 (4,153)	RE 510 (5,33)	RE 310 (3,6)	78,74	15500	26900	9900
	RE 1020 (4,153)	RE 510 (5,33)	RE 310 (4,25)	93,13	15550	26900	9900
	RE 1020 (4,153)	RE 510 (4,25)	RE 310 (6,2)	108,43	15550	26900	9900
	RE 1020 (4,153)	RE 510 (3,60)	RE 310 (7,5)	111,13	15550	26900	9900
	RE 1020 (4,153)	RE 510 (5,33)	RE 310 (5,33)	117,13	15570	26900	9900
	RE 1020 (4,153)	RE 510 (4,25)	RE 310 (7,5)	131,38	15570	26900	9900
	RE 1020 (4,153)	RE 510 (5,33)	RE 310 (6,2)	136,33	15590	26900	9900
	RE 1020 (4,153)	RE 510 (5,33)	RE 310 (7,5)	165,12	15600	26900	9900

SIZE	STAGE 1	STAGE 2	STAGE 3	RATIO	L2 -T5 FEM TORQUE at 15 rpm [Nm]	MAX STATIC TORQUE [Nm]	SOLAS TORQUE [Nm]
WD 1500	RE 1520 (4,09)	RE 810 (3,56)	RE 310 (3,6)	51,47	25200	43230	17730
	RE 1520 (4,09)	RE 810 (4,154)	RE 310 (3,6)	60,17	25300	43230	17730
	RE 1520 (4,09)	RE 810 (4,154)	RE 310 (4,25)	71,22	25350	43230	17730
	RE 1520 (4,09)	RE 810 (5,10)	RE 310 (3,6)	74,11	25350	43230	17730
	RE 1520 (4,09)	RE 810 (3,56)	RE 310 (5,33)	76,73	25350	43230	17730
	RE 1520 (4,09)	RE 810 (5,10)	RE 310 (4,25)	87,67	25400	43230	17730
	RE 1520 (4,09)	RE 810 (4,154)	RE 310 (5,33)	89,63	25400	43230	17730
	RE 1520 (4,09)	RE 810 (4,154)	RE 310 (6,20)	104,36	25450	43230	17730
	RE 1520 (4,09)	RE 810 (3,56)	RE 310 (7,5)	108,30	22000	43230	17730
	RE 1520 (4,09)	RE 810 (5,10)	RE 310 (5,33)	110,27	25450	43230	17730
	RE 1520 (4,09)	RE 810 (4,154)	RE 310 (7,5)	126,45	24600	43230	17730
	RE 1520 (4,09)	RE 810 (5,10)	RE 310 (6,20)	128,35	25500	43230	17730
	RE 1520 (4,09)	RE 810 (5,10)	RE 310 (7,5)	155,48	25500	43230	17730
WD 2000	RE 2000 (3,83)	RE 810 (3,562)	RE 310 (3,60)	48,16	30400	57900	23664
	RE 2000 (3,83)	RE 810 (4,153)	RE 310 (3,60)	56,31	30500	57900	23664
	RE 2000 (3,83)	RE 810 (3,562)	RE 310 (4,25)	57,03	30500	57900	23664
	RE 2000 (3,83)	RE 810 (4,153)	RE 310 (4,25)	66,66	30600	57900	23664
	RE 2000 (3,83)	RE 810 (5,10)	RE 310 (3,60)	69,38	30600	57900	23664
	RE 2000 (3,83)	RE 810 (3,562)	RE 310 (5,333)	71,82	30600	57900	23664
	RE 2000 (3,83)	RE 810 (5,10)	RE 310 (4,25)	82,09	30700	57900	23664
	RE 2000 (3,83)	RE 810 (4,153)	RE 310 (5,333)	83,90	30700	57900	23664
	RE 2000 (3,83)	RE 810 (4,153)	RE 310 (6,2)	97,70	30700	57900	23664
	RE 2000 (3,83)	RE 810 (5,10)	RE 310 (5,333)	103,26	30800	57900	23664
	RE 2000 (3,83)	RE 810 (5,10)	RE 310 (6,2)	120,21	30800	57900	23664
	RE 2000 (3,83)	RE 810 (5,10)	RE 310 (7,50)	145,62	28000	57900	23664
WD 2500	RE 2520 (4,00)	RE 1020 (3,562)	RE 510 (3,6)	50,29	47500	70000	31080
	RE 2520 (4,00)	RE 1020 (4,154)	RE 510 (3,6)	58,82	48000	70000	31080
	RE 2520 (4,00)	RE 1020 (3,562)	RE 510 (4,25)	59,55	48000	70000	31080
	RE 2520 (4,00)	RE 1020 (4,154)	RE 510 (4,25)	69,62	48500	70000	31080
	RE 2520 (4,00)	RE 1020 (5,1)	RE 510 (3,6)	72,44	43500	70000	31080
	RE 2520 (4,00)	RE 1020 (3,562)	RE 510 (5,333)	74,98	48000	70000	31080
	RE 2520 (4,00)	RE 1020 (5,1)	RE 510 (4,25)	85,70	43500	70000	31080
	RE 2520 (4,00)	RE 1020 (3,562)	RE 510 (6,2)	87,34	48500	70000	31080
	RE 2520 (4,00)	RE 1020 (5,823)	RE 510 (4,25)	97,99	37500	70000	31080
	RE 2520 (4,00)	RE 1020 (4,154)	RE 510 (6,2)	102,02	48500	70000	31080
	RE 2520 (4,00)	RE 1020 (3,562)	RE 510 (7,5)	105,86	41300	70000	31080
	RE 2520 (4,00)	RE 1020 (5,1)	RE 510 (5,333)	107,79	43500	70000	31080
	RE 2520 (4,00)	RE 1020 (4,154)	RE 510 (7,5)	123,62	48000	70000	31080
	RE 2520 (4,00)	RE 1020 (5,1)	RE 510 (6,2)	125,48	43500	70000	31080
	RE 2520 (4,00)	RE 1020 (5,1)	RE 510 (7,5)	152,00	43500	70000	31080

SIZE	STAGE 1	STAGE 2	STAGE 3	RATIO	L2 -T5 FEM TORQUE at 15 rpm [Nm]	MAX STATIC TORQUE [Nm]	SOLAS TORQUE [Nm]
WD 3000	RE 3000 (4,00)	RE 1020 (3,562)	RE 810 (3,562)	49,75	50000	93300	40450
	RE 3000 (4,00)	RE 1020 (3,562)	RE 810 (4,154)	58,19	50000	93300	40450
	RE 3000 (4,00)	RE 1020 (4,154)	RE 810 (4,154)	68,02	49300	93300	39600
	RE 3000 (4,00)	RE 1020 (3,562)	RE 810 (5,1)	71,66	50000	93300	40450
	RE 3000 (4,00)	RE 1020 (3,562)	RE 810 (5,823)	81,97	50000	93300	40450
	RE 3000 (4,00)	RE 1020 (4,154)	RE 810 (5,1)	83,74	49300	93300	39600
	RE 3000 (4,00)	RE 1020 (4,154)	RE 810 (5,823)	95,75	49300	93300	39600
	RE 3000 (4,00)	RE 1020 (3,562)	RE 810 (6,857)	96,70	50000	93300	40450
	RE 3000 (4,00)	RE 1020 (5,1)	RE 810 (5,1)	103,04	46500	90600	35950
	RE 3000 (4,00)	RE 1020 (4,154)	RE 810 (6,857)	112,94	50000	93300	39600
	RE 3000 (4,00)	RE 1020 (5,1)	RE 810 (5,823)	117,79	46500	90600	35950
	RE 3000 (4,00)	RE 1020 (5,1)	RE 810 (6,857)	138,88	46500	90600	35950
WD 4800	RE4800 (3,84)	RE 2000 (3,833)	RE 510 (3,6)	51,99	79000	123300	47350
	RE4800 (3,84)	RE 2000 (3,833)	RE 510 (4,25)	61,55	79500	123300	47350
	RE4800 (3,84)	RE 2000 (5,25)	RE 510 (3,6)	71,58	80000	123300	51000
	RE4800 (3,84)	RE 2000 (3,833)	RE 510 (5,33)	77,49	72500	123300	47350
	RE4800 (3,84)	RE 2000 (5,25)	RE 510 (4,256)	84,68	80000	123300	51000
	RE4800 (3,84)	RE 2000 (3,833)	RE 510 (6,2)	90,26	59000	123300	47350
	RE4800 (3,84)	RE 2000 (5,25)	RE 510 (5,333)	106,51	80000	123300	51000
	RE4800 (3,84)	RE 2000 (3,833)	RE 510 (7,5)	109,39	42500	103250	47350
	RE4800 (3,84)	RE 2000 (5,25)	RE 510 (6,2)	123,99	75000	123300	51000
	RE4800 (3,84)	RE 2000 (5,25)	RE 510 (7,5)	150,20	55000	123300	51000
WD 8000	RE8000 (4,00)	RE 2520 (4,00)	RE 1020 (3,562)	56,0	105000	197200	84900
	RE8000 (4,00)	RE 2520 (4,00)	RE 1020 (4,153)	65,45	105000	197200	84900
	RE8000 (4,00)	RE 2520 (5,20)	RE 1020 (3,562)	73,1	105000	197200	84900
	RE8000 (4,00)	RE 2520 (5,20)	RE 1020 (4,153)	85,38	105000	197200	84900
	RE8000 (4,00)	RE 2520 (4,00)	RE 1020 (5,823)	92,17	105000	197200	84900
	RE8000 (4,00)	RE 2520 (5,20)	RE 1020 (5,1)	105,08	105000	197200	82300
	RE8000 (4,00)	RE 2520 (4,00)	RE 1020 (6,857	108,71	88000	197200	84900
	RE8000 (4,00)	RE 2520 (5,20)	RE 1020 (5,823	120,12	105000	197200	84900
	RE8000 (4,00)	RE 2520 (6,25)	RE 1020 (5,1)	126,50	99500	174600	84900
	RE8000 (4,00)	RE 2520 (5,2)	RE 1020 (6,857)	141,63	105000	197200	84900
	RE8000 (4,00)	RE 2520 (6,25)	RE 1020 (6,857)	170,43	99500	174600	84900

Conversion matrix for different loadspectrum and time classes. Factor is to be multiplied with L2 - T5 torque for the different gearboxes to find the allowable torque for the specific loadclass and spectrum.

	T0	T1	T2	T3	T4	T5	T6	T7	T8
Life in hours	200	400	800	1600	3200	6400	12500	2500	50000
L1	1.48	1.35	1.25	1.19	1.08	1.01	0.92	0.83	0.76
L2	1.47	1.34	1.24	1.18	1.07	1.00	0.91	0.82	0.75
L3	1.09	1.00	0.92	0.85	0.77	0.71	0.63	0.60	0.57
L4	0.94	0.85	0.77	0.73	0.64	0.60	0.57	0.55	0.52

Brakes type FW and FY with static brake torque as given in table below

BRAKE TABLE FW – FY

	FW02	FW03	FW05	FW08	FW11	FW13	FW16	FY22	FY27	FY36
Spacer disk (mm)	33.4	29.7	26	20.8	13	10.4	5.2	25.9	22.2	14.8
Sintered disk 415040400	2	3	4	6	9	10	12	5	6	8
Steel disk 415030800	3	4	5	7	10	11	13	6	7	9
No. springs 027010100	12	12	14	14	14	14	14	32	32	32
Static Braking Torque (Nm)	230	340	550	800	1100	1300	1600	2200	2700	3600
Total opening pressure (Bar)	18	18	18	18	18	18	18	18	18	18

The given friction coefficient has not been evaluated.The friction coefficient is lower that the upper limitation of 0.3 given in DNVGL-ST-0378.

Manufactured by

Dynamic Oil
Via Togliatti 15
41030 Bomporto MO – Italy

Application/Limitation

1. The approval is based on the assumption the structural steel for gear teeth is case hardened min Grade ME, with min endurance limit as per ISO 6336.
2. Materials with 3.1 certificates are to be used when manufacturing load carrying parts. Traceability is assumed to be taken care of by the manufacturer's quality system.
3. Upon final installation of gear unit to foundation/frame the fastening bolts are to be pre-stressed according to procedures acceptable to the attending surveyor. We have assumed that the load carrying bolts are of 8.8 quality or higher.
4. Our gear calculations are based on that optimum hardening depths have been achieved according to recognised standards and manufacturer's experience. Material fatigue values based on 90% reliability of survival have been applied according to the requirements for lifting appliances in our rules. Load distribution factors as stated by the manufacturer (based on manufacurers experience) have been used and we have not considered these.
5. The bearing lifetime is not evaluated in this Type Approval. It is assumed that the manufacturer delivers bearings with sufficient capacity for the class of utilization.

Type Approval documentation

Drawing No.	***Rev.***	***DNVGL No.***	***Title***	***Code***
02221386 Model (1)	2	300	Female planetary carrier (turned)	C3
02621037 Model (1)	3	305	Planetary gear R=5,25	C3
02621044 Model (1)	4	306	Planetary gear R=3,84	C3
02621108 Model (1)	1	307	Planetary gear R=3,83	C3
02621110 Model (1)	1	308	Planetary gear R=5,17	C3
02621114 Model (1)	5	309	Planetary gear R=4	C3
02621115 Model (1)	2	310	Planetary gear R=4,67	C3
22210143	5	357	Input side planetary carrier	C3

22210144	0	358	Input side planetary carrier R. 3,83	C3
23310133	5	359	Carrier flange 3,83	C3
25810103	0	360	Planetary carrier pin	C3
26110128	0	361	Drilled sun gear R. 3,83	C3
26210179	0	362	Planetary gear R=3,83	C3
22210639	1	364	Input plantary carrier 5,25	C3
23310188	1	365	Carrier flange 5,25	C3
26010711	0	366	Planetary carrier column pin	C3
26110406	0	367	Drilled sun gear R. 5,25	C3
26210180	0	368	Planetary gear R=5,25	C3
22210149	5	370	Input side planetary carrier	C3
22210150	0	371	Input side planetary carrier R. 4	C3
2231015	11	372	Ring gear	C3
23310123	7	373	Carrier flange	C3
25810104	0	374	Planetary carrier pin	C3
26010167	0	375	Planetary carrier column pin	C3
26110130	0	376	Drilled sun gear R. 1:4	C3
26210185	0	377	Planetary gear R=4	C3
22210122	3	379	Input side planetary carrier	C3
22210123	0	380	Input side planetary carrier R. 3,84	C3
2231030	10	381	Ring gear	C3
23310125	8	382	Carrier flange for FW	C3
25510103	0	383	Drilled end plate	C3
25810100	0	384	Planetary carrier pin	C3
26010162	0	385	Planetary carrier column pin	C3
26110138	0	386	Drilled sun gear R. 3,84	C3
26210181	0	387	Planetary gear R=3,84	C3
27410142	0	388	Fifth wheel 54x80x2,5	C3
22210594	4	390	Input planetary carrier R. 5,17	C3
23310173	3	391	Carrier flange for FW	C3
26010675	0	392	Planetary carrier column pin	C3
2611491	2	393	Sun gear R. 1:5,17	C3
26210182	0	394	Planetary gear R=5,17	C3
29710600	0	395	Drilled sun gear RE4800 5,17	C3
22210153	6	397	Input side planetary carrier	C3
22210154	0	398	Input side planetary carrier R. 4	C3
2231084	6	399	Ring gear	C3
23310134	6	400	Carrier flange	C3
25810125	0	401	Planetary carrier pin	C3
26010170	0	402	Planetary carrier column pin	C3
26110144	2	403	Drilled sun gear R. 1:4	C3
26210183	0	404	Planetary gear R=4	C3
22210629	4	406	Input planetary carrier R. 4,67	C3
23310182	3	407	Carrier flange 4,67	C3
26110385	0	408	Drilled sun gear R:4,67 RE 8000	C3
26210184	0	409	Planetary gear R=4,67	C3
-	-	350	Calculation of the load sharing factor_007	C1
02621114 Model (1)	5	309	Planetary gear R=4	C3
02621115 Model (1)	2	310	Planetary gear R=4,67	C3
22210143	5	357	Input side planetary carrier	C3
22210144	0	358	Input side planetary carrier R. 3,83	C3
23310133	5	359	Carrier flange 3,83	C3
25810103	0	360	Planetary carrier pin	C3

Tests carried out

After completion the gears are to be function and pressure tested prior to issuance of a DNVGL product certificate

Marking of product

The product to be marked with manufacturer's name or trademark and type number identification

Periodical assessment

For retention of the Type Approval, a DNV GL Surveyor shall perform periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the approval are complied with. Reference is made to DNVGL-CP-0338.

END OF CERTIFICATE