DET NORSKE VERITAS

TYPE APPROVAL CERTIFICATE

CERTIFICATE NO. **S-7213**

This is to certify that the
Gears

with type designation(s)

RW series

Manufactured by
DINAMIC OIL SPA
BOMPORTO MO, Italy

is found to comply with
Standard for Certification No. 2.22 Lifting Appliances
IMO/SOLAS 1974 as amended in IMO Res. MSC 47(66) and the LSA Code (MSC 48(66))

Application
Planetary gear units with optional failsafe brakes and sprag clutch, for hoist applications.

Høvik, 2012-12-07
for **Det Norske Veritas AS**

Aldo Matteucci
Head of Section

DNV local office:
Venice

This Certificate is valid until
2016-12-31

Harald Jensen
Surveyor

DET NORSKE VERITAS * 1864 *

BIXL

Product description

Planetary gear unit with 2 and 3 stages, and rotating housing. Output speed is 15 rpm. If other output speed is required, the number of hours is to be interpolated. Load spectrum and classes of utilisation (based on principles according to F.E.M. 1.001 3rd edition) are defined below.

For selection of gearbox, manufacturer has to consider the following torques, to find the dimensioning:

- Max torque for relevant class Lx-Ty
- Max dynamic torque
- Max brake torque (divided by 1,8 if a DNV product certificate is to be obtained)

Definition of load spectrum:

Class	Load in % of max	Fraction of total time	Km
L1	100 60 50 29	3 10 52 35	0,125
L2	100 60 50 40	2 65 23 10	0,196
L3	100 80 68 5	25 33 30 12	0,513
L4	100	100	1,000

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

Max allowable torques for L2-T5 for the 2 staged series:

SIZE	STAGE 1	STAGE 2	RATIO	L2-T5 at 15 rpm [Nm]	SOLAS TORQUE [Nm]
RW512	RE 510 (4,25)	RE 210 (3,48)	13,79	6573	2607
	RE 510 (4,25)	RE 210 (4,26)	17,12	6666	3194
	RE 510 (5,33)	RE 210 (4,26)	21,74	5960	4008
	RE 510 (4,25)	RE 210 (5,77)	23,52	5754	4322

	RE 510 (5,33)	RE 210 (5,77)	29,77	6026	4348
	RE 510 (6,2)	RE 210 (5,77)	34,77	4615	3491
	RE 510 (5,33)	RE 210 (7,2)	37,40	4299	4348
	RE 510 (6,2)	RE 210 (7,2)	43,64	4642	3491
RW612	RE 610 (4)	RE 310 (3,6)	13,40	7939	3482
	RE 610 (4)	RE 310 (4,25)	16,00	8030	4111
	RE 610 (4,55)	RE 310 (4,25)	18,32	7767	4671
	RE 610 (4)	RE 310 (5,33)	20,33	8137	5359
	RE 610 (4)	RE 310 (6,2)	23,80	7737	5359
	RE 610 (4,55)	RE 310 (6,2)	27,18	7900	6077
	RE 610 (4)	RE 310 (7,5)	29,00	5044	5359
	RE 610 (4,55)	RE 310 (7,5)	33,09	5668	6077
RW812	RE 810 (3,56)	RE 310 (4,25)	14,14	9875	3661
	RE 810 (3,56)	RE 310 (5,33)	18,00	8990	4595
	RE 810 (4,15)	RE 310 (5,33)	21,15	9048	5357
	RE 810 (4,15)	RE 310 (6,2)	24,75	8015	6228
	RE 810 (5,1)	RE 310 (6,2)	30,62	8725	6211
	RE 810 (5,82)	RE 310 (6,2)	35,11	7334	5520
	RE 810 (5,1)	RE 310 (7,5)	37,25	6292	6211
	RE 810 (5,82)	RE 310 (7,5)	42,68	7090	5520
RW1022	RE 1020 (3,56)	RE 510 (4,25)	14,14	13740	3661
	RE 1020 (4,15)	RE 510 (4,25)	16,65	13021	4269
	RE 1020 (3,56)	RE 510 (5,33)	18,00	13946	4595
	RE 1020 (3,56)	RE 510 (6,2)	21,09	14046	5357
	RE 1020 (4,15)	RE 510 (6,2)	24,75	13267	6228
	RE 1020 (4,15)	RE 510 (7,5)	30,15	10872	7534
	RE 1020 (5,1)	RE 510 (7,5)	37,25	11727	8982
	RE 1020 (5,82)	RE 510 (7,5)	42,68	9683	7985
RW1532	RE 1530 (5,25)	RE 510 (3,6)	17,90	18030	10633
	RE 1530 (4,09)	RE 510 (5,33)	20,82	20407	12274
	RE 1530 (4,09)	RE 510 (6,2)	24,36	16328	14269
	RE 1530 (5,25)	RE 510 (5,33)	27,00	18369	15700
	RE 1530 (4,09)	RE 510 (7,5)	29,68	10721	14914
	RE 1530 (5,25)	RE 510 (6,2)	31,55	18453	15700
	RE 1530 (5,25)	RE 510 (7,5)	38,38	13435	15700
	RE 1530 (6,23)	RE 510 (7,5)	45,73	13484	13722
RW2522	RE 2520 (5,2)	RE 810 (3,56)	17,53	30680	11023
	RE 2520 (4)	RE 810 (5,1)	19,40	28232	12138
	RE 2520 (6,25)	RE 810 (3,56)	21,27	21859	13248
	RE 2520 (5,2)	RE 810 (5,1)	25,52	31186	15780
	RE 2520 (5,2)	RE 810 (5,82)	29,28	31357	17107
	RE 2520 (6,25)	RE 810 (5,1)	30,88	22154	17107
	RE 2520 (5,2)	RE 810 (6,86)	34,66	24225	17107
	RE 2520 (6,25)	RE 810 (6,86)	41,86	22328	17107
RW3512	RE 3510 (4,74)	RE 1020 (3,56)	15,88	50130	19178
	RE 3510 (4,74)	RE 1020 (4,15)	18,68	50071	22362
	RE 3510 (5,44)	RE 1020 (4,15)	21,59	40897	25670
	RE 3510 (4,74)	RE 1020 (5,1)	23,16	44128	27455
	RE 3510 (4,74)	RE 1020 (5,82)	26,59	39041	31350
	RE 3510 (5,44)	RE 1020 (5,82)	30,67	41427	35386

	RE 3510 (5,44)	RE 1020 (6,86)	36,29	31614	35386
	RE 3510 (6,46)	RE 1020 (6,86)	43,31	30458	35718

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

SIZE	STAGE 1	STAGE 2	STAGE 3	RATIO	L2-T5 at 15 rpm [Nm]	SOLAS TORQUE [Nm]
RW 513	RE 510 (3,6)	RE 210 (3,48)	RE 110 (3,48)	42,60	7476	3937
	RE 510 (3,6)	RE 210 (3,48)	RE 110 (4,26)	52,41	7514	3937
	RE 510 (4,25)	RE 210 (3,48)	RE 110 (4,26)	62,05	6943	4348
	RE 510 (3,6)	RE 210 (4,26)	RE 110 (4,26)	64,43	7546	3937
	RE 510 (3,6)	RE 210 (3,48)	RE 110 (5,77)	71,28	7080	3937
	RE 510 (4,25)	RE 210 (4,26)	RE 110 (4,26)	76,24	6969	4348
	RE 510 (4,25)	RE 210 (3,48)	RE 110 (5,77)	84,33	6966	4348
	RE 510 (3,6)	RE 210 (3,48)	RE 110 (7,2)	89,20	3911	3937
	RE 510 (5,33)	RE 210 (4,26)	RE 110 (4,26)	95,93	6174	4348
	RE 510 (4,25)	RE 210 (3,48)	RE 110 (7,2)	105,49	4494	4348
	RE 510 (3,6)	RE 210 (4,26)	RE 110 (7,2)	109,50	4634	3937
	RE 510 (6,2)	RE 210 (3,48)	RE 110 (5,77)	123,48	4710	3491
	RE 510 (4,25)	RE 210 (4,26)	RE 110 (7,2)	129,45	5343	4348
	RE 510 (6,2)	RE 210 (3,48)	RE 110 (7,2)	154,35	4718	3491
	RE 510 (5,33)	RE 210 (4,26)	RE 110 (7,2)	162,71	6196	4348
	RE 510 (6,2)	RE 210 (4,26)	RE 110 (7,2)	189,31	4727	3491
RW 613	RE 610 (4)	RE 310 (3,6)	RE 110 (3,48)	49,11	8361	5359
	RE 610 (4,55)	RE 310 (3,6)	RE 110 (3,48)	55,95	8047	6077
	RE 610 (4)	RE 310 (3,6)	RE 110 (4,26)	60,39	8399	5359
	RE 610 (4,55)	RE 310 (3,6)	RE 110 (4,26)	68,76	8079	6077
	RE 610 (4)	RE 310 (5,33)	RE 110 (3,48)	73,24	8422	5359
	RE 610 (4,55)	RE 310 (5,33)	RE 110 (3,48)	83,36	8099	6077
	RE 610 (4,55)	RE 310 (3,6)	RE 110 (5,77)	93,41	8103	6077
	RE 610 (4,55)	RE 310 (6,2)	RE 110 (3,48)	97,07	8107	5359
	RE 610 (4,55)	RE 310 (5,33)	RE 110 (4,26)	102,35	8123	6077
	RE 610 (4,55)	RE 310 (4,25)	RE 110 (5,77)	110,45	8116	6077
	RE 610 (4)	RE 310 (5,33)	RE 110 (5,77)	122,08	8466	5359
	RE 610 (4)	RE 310 (6,2)	RE 110 (5,77)	142,08	8005	5359
	RE 610 (4)	RE 310 (5,33)	RE 110 (7,2)	152,60	6231	5359
	RE 610 (4,55)	RE 310 (6,2)	RE 110 (5,77)	161,59	8139	6077
	RE 610 (4,55)	RE 310 (5,33)	RE 110 (7,2)	173,55	6916	6077
	RE 610 (4,55)	RE 310 (6,2)	RE 110 (7,2)	201,91	7983	6077
RW 813	RE 810 (3,56)	RE 310 (3,6)	RE 110 (3,48)	43,63	9820	7204
	RE 810 (3,56)	RE 310 (3,6)	RE 110 (4,26)	53,68	9870	7033
	RE 810 (3,56)	RE 310 (4,25)	RE 110 (4,26)	63,55	9895	7033
	RE 810 (4,15)	RE 310 (5,33)	RE 110 (3,48)	76,10	9350	6836
	RE 810 (3,56)	RE 310 (4,25)	RE 110 (5,77)	86,35	8339	7033
	RE 810 (4,15)	RE 310 (5,33)	RE 110 (4,26)	93,45	9380	6836
	RE 810 (4,15)	RE 310 (4,25)	RE 110 (5,77)	100,85	9510	6836
	RE 810 (3,56)	RE 310 (5,33)	RE 110 (5,77)	108,62	9402	7033
	RE 810 (5,1)	RE 310 (5,33)	RE 110 (4,26)	114,96	8944	6211
	RE 810 (4,15)	RE 310 (5,33)	RE 110 (5,77)	126,81	9400	6836
	RE 810 (3,56)	RE 310 (5,33)	RE 110 (7,2)	135,80	5613	7033

	RE 810 (4,15)	RE 310 (6,2)	RE 110 (5,77)	147,58	8281	6836
	RE 810 (4,15)	RE 310 (5,33)	RE 110 (7,2)	158,51	6415	6836
	RE 810 (4,15)	RE 310 (6,2)	RE 110 (7,2)	184,43	7327	6836
	RE 810 (5,1)	RE 310 (5,33)	RE 110 (7,2)	194,84	7720	6211
	RE 810 (5,82)	RE 310 (6,2)	RE 110 (5,77)	207,30	7505	5520
RW 1023	RE 1020 (3,56)	RE 510 (3,6)	RE 210 (3,48)	43,63	13897	10495
	RE 1020 (3,56)	RE 510 (3,6)	RE 210 (4,26)	53,68	13966	10495
	RE 1020 (3,56)	RE 510 (5,33)	RE 210 (3,48)	65,12	14009	10495
	RE 1020 (3,56)	RE 510 (3,6)	RE 210 (5,77)	72,99	14022	10495
	RE 1020 (3,56)	RE 510 (5,33)	RE 210 (4,26)	80,00	14059	10495
	RE 1020 (3,56)	RE 510 (6,2)	RE 210 (4,26)	93,16	14075	10495
	RE 1020 (4,15)	RE 510 (4,25)	RE 210 (5,77)	100,85	13262	9901
	RE 1020 (4,15)	RE 510 (6,2)	RE 210 (4,26)	108,79	13284	10495
	RE 1020 (4,15)	RE 510 (5,33)	RE 210 (5,77)	126,81	13298	9901
	RE 1020 (3,56)	RE 510 (5,33)	RE 210 (7,2)	135,80	12978	10495
	RE 1020 (4,15)	RE 510 (6,2)	RE 210 (5,77)	147,58	13304	9901
	RE 1020 (3,56)	RE 510 (6,2)	RE 210 (7,2)	158,03	14126	9901
	RE 1020 (6,86)	RE 510 (4,25)	RE 210 (5,77)	167,13	6594	6343
	RE 1020 (4,15)	RE 510 (6,2)	RE 210 (7,2)	184,43	13324	9901
	RE 1020 (5,82)	RE 510 (6,2)	RE 210 (5,77)	207,30	9309	7985
	RE 1020 (5,1)	RE 510 (6,2)	RE 210 (7,2)	226,66	11641	8982
RW 1533	RE 1530 (4,09)	RE 510 (3,6)	RE 210 (3,48)	50,25	25230	12395
	RE 1530 (4,09)	RE 510 (3,6)	RE 210 (4,26)	61,78	25341	14914
	RE 1530 (4,09)	RE 510 (4,25)	RE 210 (4,26)	73,12	23528	14914
	RE 1530 (4,09)	RE 510 (3,6)	RE 210 (5,77)	83,97	17455	14914
	RE 1530 (4,09)	RE 510 (5,33)	RE 210 (4,26)	92,01	21173	14914
	RE 1530 (4,09)	RE 510 (4,25)	RE 210 (5,77)	99,31	20119	14914
	RE 1530 (5,25)	RE 510 (3,6)	RE 210 (5,77)	108,04	18861	15700
	RE 1530 (5,25)	RE 510 (5,33)	RE 210 (4,26)	118,37	18904	15700
	RE 1530 (4,09)	RE 510 (5,33)	RE 210 (5,77)	124,87	21215	14914
	RE 1530 (5,25)	RE 510 (6,2)	RE 210 (4,26)	137,77	18914	15700
	RE 1530 (4,09)	RE 510 (5,33)	RE 210 (7,2)	156,09	14523	14914
	RE 1530 (5,25)	RE 510 (5,33)	RE 210 (5,77)	160,54	18929	15700
	RE 1530 (5,25)	RE 510 (6,2)	RE 210 (5,77)	186,79	18934	15700
	RE 1530 (5,25)	RE 510 (5,33)	RE 210 (7,2)	200,60	18212	15700
	RE 1530 (6,23)	RE 510 (6,2)	RE 210 (5,77)	221,87	13715	13722
	RE 1530 (5,25)	RE 510 (6,2)	RE 210 (7,2)	233,36	18956	15700
RW 2523	RE 2520 (4)	RE 810 (3,56)	RE 310 (3,6)	50,30	33975	17107
	RE 2520 (4)	RE 810 (3,56)	RE 310 (4,25)	59,56	34078	17107
	RE 2520 (4)	RE 810 (4,15)	RE 310 (4,25)	69,62	29140	17107
	RE 2520 (5,2)	RE 810 (3,56)	RE 310 (4,25)	77,73	32019	17107
	RE 2520 (4)	RE 810 (4,15)	RE 310 (5,33)	87,62	29250	17107
	RE 2520 (5,2)	RE 810 (5,1)	RE 310 (3,6)	94,47	32069	17107
	RE 2520 (4)	RE 810 (4,15)	RE 310 (6,2)	102,02	27529	17107
	RE 2520 (4)	RE 810 (5,1)	RE 310 (5,33)	107,80	29433	17107
	RE 2520 (5,2)	RE 810 (4,15)	RE 310 (5,33)	114,20	32177	17107
	RE 2520 (4)	RE 810 (5,1)	RE 310 (6,2)	125,48	29453	17107
	RE 2520 (5,2)	RE 810 (5,1)	RE 310 (5,33)	140,44	32199	17107
	RE 2520 (4)	RE 810 (5,1)	RE 310 (7,5)	152,00	21537	17107
	RE 2520 (5,2)	RE 810 (5,1)	RE 310 (6,2)	163,42	32211	17107

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	RE 2520 (5,2)	RE 810 (5,82)	RE 310 (6,2)	186,75	32255	17107
	RE 2520 (5,2)	RE 810 (5,1)	RE 310 (7,5)	197,90	27251	17107
	RE 2520 (5,2)	RE 810 (6,86)	RE 310 (7,5)	266,43	24831	17107
RW 3513	RE 3510 (3,84)	RE 1020 (3,56)	RE 510 (3,6)	48,25	45913	27705
	RE 3510 (3,84)	RE 1020 (3,56)	RE 510 (4,25)	57,14	46059	32708
	RE 3510 (4,74)	RE 1020 (3,56)	RE 510 (4,25)	70,72	52550	36944
	RE 3510 (3,84)	RE 1020 (3,56)	RE 510 (6,2)	83,82	46312	39247
	RE 3510 (4,74)	RE 1020 (3,56)	RE 510 (5,33)	89,00	52730	36944
	RE 3510 (3,84)	RE 1020 (4,15)	RE 510 (6,2)	97,89	43608	38020
	RE 3510 (4,74)	RE 1020 (4,15)	RE 510 (5,33)	103,94	52282	34492
	RE 3510 (3,84)	RE 1020 (4,15)	RE 510 (7,5)	118,63	35803	38020
	RE 3510 (4,74)	RE 1020 (5,1)	RE 510 (5,33)	127,84	45705	36944
	RE 3510 (5,44)	RE 1020 (4,15)	RE 510 (6,2)	139,04	42486	35386
	RE 3510 (4,74)	RE 1020 (5,1)	RE 510 (6,2)	148,78	45726	36944
	RE 3510 (4,74)	RE 1020 (5,82)	RE 510 (6,2)	170,03	40272	36944
	RE 3510 (4,74)	RE 1020 (5,1)	RE 510 (7,5)	180,18	45779	36944
	RE 3510 (5,44)	RE 1020 (5,82)	RE 510 (6,2)	195,33	42560	35386
	RE 3510 (4,74)	RE 1020 (5,82)	RE 510 (7,5)	205,89	40313	36944
	RE 3510 (5,44)	RE 1020 (5,82)	RE 510 (7,5)	236,49	42598	35386

Conversion matrix for different load spectrums and time classes. Factor is to be multiplied with L2-T5 torque for the different gearboxes to find the maximum 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	6300	12500	25000	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

Standard multi-disc failsafe brake design. The number of lamella and spring packages is adjusted to obtain the correct brake torque for the specific application. Brake torque shall be 1.8 in excess of the maximum torque on the brake caused by the loads being regarded as static loads. The given friction coefficients have not been evaluated.

Max static torques:

	F501/601	F502/602	F503/603	F504/604	F506/606
Max static torque (Nm)	112	225	309	422	656

	F902	F903	F904	F905	F906	F908	F910	F912	F915
Max static torque (Nm)	260	328	468	520	728	910	1040	1300	1560

	F01	F10	F11	F12	F13	F14	F15	F16	F17
Static torque (Nm)	128-136	128-136	176-187	227-242	322-342	453-482	513-546	588-626	640-680

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Application/Limitation

1. Materials with 3.1 certificates are to be used when manufacturing load carrying parts. Traceability is assumed taken care of by he manufacturer's quality system.

2. 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.

3. 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 have been used and we have not considered these.

4. 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.

5. Freewheel sprag clutch is to be delivered with the manufacturers certificate documenting sufficient capacity.

Type Approval documentation

Drawings of sun wheels, planets, ring gears, planetary carriers, housing, brakes and shafts for all stages and calculations stamped 2008-06-03, ref. Drawing List "DRLI-001 rev. 01".

Tests carried out

- For delivery according to DNVs Standard for Certification No. 2.22 "Lifting Appliances" 2011, the gears are to be function and load tested according to Ch.2 Sec12 prior to issuance of a DNV product certificate.
- For delivery according to SOLAS a functional test is to be carried out showing compliance with IMO Resolution MSC 81(70) "Testing Part II".

Marking of product

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

Certificate Retention Survey

For retention of the Type Approval, DNV surveyor shall perform a survey every second year and before expiry date of this certificate in order to verify that the conditions of the type approval are complied with.

END OF CERTIFICATE