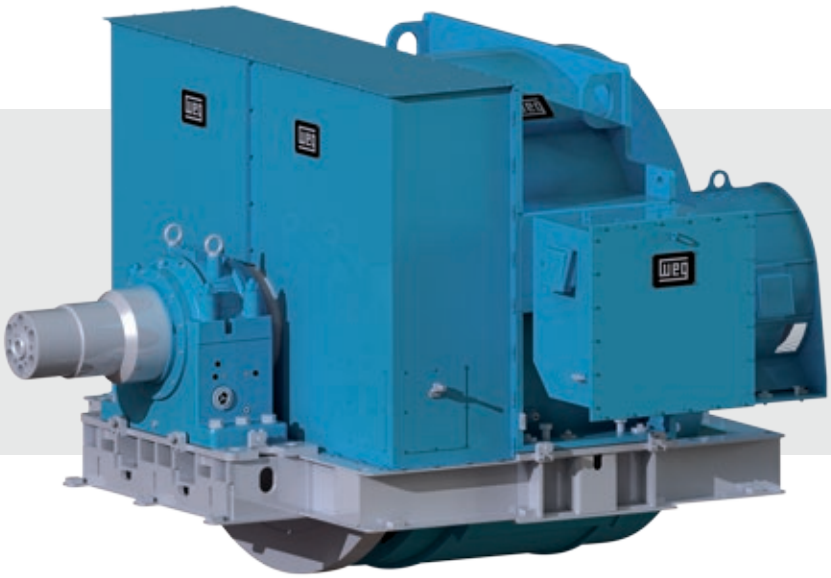
Energy

Hydrogenerators

Hydrogenerators

Designed for applications in hydro power plants, WEG hydrogenerators offer a wide range of options both for output and speed. With our experience and the benefit of extensive market research we have designed a range of hydrogenerators suitable to be driven by Kaplan, Francis and Pelton turbines, among others, offering different mechanical and electrical configurations.



Technical Features

- Outputs: from 500 to 150,000 kVA
- Voltages: up to 13,800 V, 50 or 60 Hz
- Degree of protection: IP21 to IP44
- Speed: 1,800 to 120 rpm
- Mounting: horizontal and vertical

Design

WEG hydrogenerators are designed with advanced software available on the market, many of them specially developed in partnerships with universities in Europe, the USA and Brazil. These tools ensure accuracy and reliability during the design process and result in high efficiency and low-maintenance.

Certifications

WEG´s quality system is certified to ISO 9001 and ISO 14001 standards and is audited and certified by the Bureau Veritas Quality Institute. WEG hydrogenerators can be supplied, upon request, with certifications from world leading certification bodies and are suitable for operation in the most demanding applications.

Sustainability

Sustainability is a key feature in WEG's development and manufacture process consideration always given to the preservation of the environment preservation of the environment. Equipment such as hydrogenerators, turbines, electrical panels, switchgears, transformers, digital monitoring and control systems and all other equipment and services required for the implementation of WEG's hydro power plants all form part of the company product portfolio supplied to hydro power plants. Hydro power plants are recognized today as one of the most important clean and renewable energy sources on global scale supplying around 20% of the world's electricity.

Manufacturing Processes

Insulation System

WEG hydrogenerators are delivered with the WEG MICATHERM insulation system. This insulation system is based on the "Vacuum Pressure Impregnation" (VPI) system which was developed in cooperation with the most renowned suppliers of insulating material all over the world. Using special epoxy based resin, this insulation system ensures perfect winding insulation of the hydrogenerators and does not emit harmful gases into the environment.
For many years, the VPI process has proved its efficiency and reliability in electrical rotating machines for a wide range of applications. This insulation system is applied to low and high voltage hydrogenerators which are constructed with 380 V to 15,000 V form coils.

Tests

WEG hydrogenerators are tested in our own modern laboratory in accordance with the IEC 60034 standard. WEG testing lab is fully computer monitored and controlled for accuracy and hydrogenerators with outputs up to 20,000 kVA and voltages up to 15,000 V can be tested. In addition to the testing performed at the factory, WEG also has experienced engineers/ technicians available to support site erection, installation and commissioning.

Winding

The winding process adopted by WEG is specially designed and specified for the voltage and application the generator is intended for. The winding of low and high voltage hydrogenerators are built with rectangular form-coils and totally insulated with porous mica tape. Conductive and semi-conductive tapes are also used to insulate the coils allowing a grounding system with the stator for an improved resistance to the corona effect.

Calendering machine

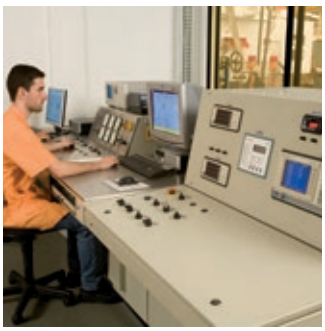
Laser cutting machine

Reaming

Vertical lathe

Winding

VPI impregnation system



Testing laboratory

GH10, GH11 and SH11 Lines

WEG produces hydrogenerators for all types of hydraulic turbines.
For applications in hydro power plants, WEG developed a standardized line of hydrogenerators that vary with the characteristics of each installation, thus expanding the application possibilities with great versatility.

The GH10 and GH11 lines was developed to meet the most common applications with smaller and simpler machines, i. e. for application of machines where not so high axial loading and inertia loads are present, no high runaway speeds are generated, etc.

This standardization allows a very practical option for the hydrogenerator in simpler solutions without losing the high efficiency and quality levels.

The SH11 line, on the other hand, with a compact and robust structure, allows the hydrogenerator to operate safely in typical load rejection and high runaway speed conditions, enabling, at the same time, the generator to run with higher inertia loads.

Advantages of GH10, GH11 and SH11 Lines

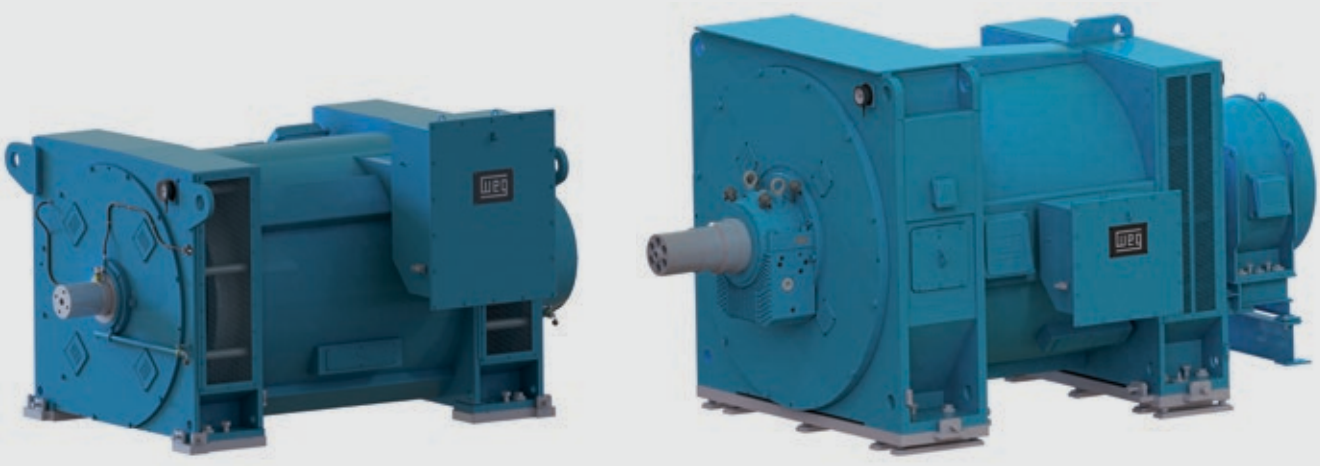
- Predefinition of the basic hydrogenerator features
- Pre-design of the main hydrogenerator components
- Manufacturing process similar to the series production
- Reduced delivery lead-time
- Easy installation & start-up
- Standardized design adaptable to specific needs is more cost effective than a one-off bespoke design

Excitation System

The GH10, GH11 and SH11 lines can be supplied with the following excitation systems:

- Brushless with/without auxiliary exciter (PMG), or
- Static exciter (with brushes) - only SH11

WEG produces the GH10, GH11 and SH11 lines both for horizontal mounting always seeking the best alternative for cost reduction, area reduction required for installation and efficiency optimization.



GH10 and GH11 Lines

The GH10 and GH11 line is an optimized hydrogenerator line aiming at high performance and cost reduction. They are suitable where there is no requirement of high inertia and the hydraulic loads are supported by the turbine bearings.

Range of Application

The GH10 and GH11 lines can be supplied with the following technical data:

- Output range: 500 kVA to 11,500 kVA
- Number of poles: 4 to 18
- Rated voltage: 400 V to 11,000 V for 50 Hz
  480 V to 13,800 V for 60 Hz

Note: other voltages upon request.

GH10 Line

Power ranges were established for the development of the GH10 line, each one corresponding to one hydrogenerator and providing the respective reference code. Table 1 shows the full application range of the GH10 line.

GH10					
Code	Output range (kVA)	400 V / 50 Hz	480 V / 60 Hz	3,300 V / 50 Hz	4,160 V / 60 Hz
A	≤500	•	•	•	•
B	>500≤1,000	•	•	•	•
C	>1,000≤1,400	•	•	•	•
D	>1,400 ≤1,600	•	•	•	•
E	>1,600 ≤1,800	•	•	•	•
F	>1,800 ≤2,000	•	•	•	•
G	>2,000 ≤2,250	•	•	•	•
H	>2,250 ≤2,500	•	•	•	•
I	>2,500 ≤2,800	•	•	•	•
J	>2,800 ≤3,150	•	•	•	•
K	>3,150 ≤3,550	•	•	•	•
L	>3,550 ≤4,000	•	•	•	•
M	>4,000 ≤4,500		•		•

Table 1 - Application range of the GH10 line

GH11 Line

Power ranges were established for the development of the GH11 line, each one corresponding to one hydrogenerator and providing the respective reference code. Table 2 shows the full application range of the GH11 line.

GH11									
Code	Output range (kVA)	400 V / 50 Hz	480 V / 60 Hz	3,300 V / 50 Hz	4,160 V / 60 Hz	6,300 V / 50 Hz	6,600 V / 60 Hz	11,000 V / 50 Hz	13,800 V / 60 Hz
C	>1,000≤1,400	•	•	•	•	•	•		
D	>1,400≤1,600	•	•	•	•	•	•		
E	>1,600≤1,800	•	•	•	•	•	•		
F	>1,800≤2,000	•	•	•	•	•	•		
G	>2,000≤2,250		•	•	•	•	•		
H	>2,250≤2,500		•	•	•	•	•		
I	>2,500≤2,800			•	•	•	•		
J	>2,800≤3,150			•	•	•	•		
K	>3,150≤3,550			•	•	•	•		
L	>3,550≤4,000			•	•	•	•		
M	>4,000≤4,500			•	•	•	•		
N	>4,500≤5,000			•	•	•	•		
O	>5,000≤5,600			•	•	•	•		
P	>5,600≤6,300			•	•	•	•		
Q	>6,300≤7,100							•	•
R	>7,100≤8,000							•	•
S	>8,000≤9,000							•	•
T	>9,000≤10,000							•	•
U	>10,000≤11,200							•	•

Table 2 - Application range of the GH11 line

GH10 and GH11 Lines

Types of Reference Hydrogenerators of the GH10 Line - 50 Hz

Output range code							
Poles/rpm	A	B	C	D	E	F	G
4/1,500	45A04	50B04	50C04	56D04	56E04	63F04	63G04
6/1,000	50A06	50B06	56C06	63D06	63E06	63F06	-
8/750	56A08	56B08	63C08	63D08	-	-	-
10/600	56A10	63B10	63C10	-	-	-	-
12/500	63A12	63B12	-	-	-	-	-
14/429	63A14	-	-	-	-	-	-

Types of Reference Hydrogenerators of the GH10 Line - 60 Hz

Output range code								
Poles/rpm	A	B	C	D	E	F	G	H
4/1,800	-	45B04	50C04	50D04	56E04	56F04	63G04	63H04
6/1,200	45A06	50B06	50C06	56D06	63E06	63F06	63G06	-
8/900	50A08	56B08	56C08	63D08	63E08	-	-	-
10/720	50A10	56B10	63C10	63D10	-	-	-	-
12/600	56A12	63B12	63C12	-	-	-	-	-
14/514	63A14	63B14	-	-	-	-	-	-
16/450	63A16	-	-	-	-	-	-	-

Types of Reference Hydrogenerators of the GH11 Line - 50 Hz

Output range code																		
Poles/rpm	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
8/750	-	-	-	-	-	-	63I08	63J08	63K08	07L08	07M08	07N08	07O08	08P08	08Q08	09R08	09S08	09T08
10/600	-	-	-	-	63G10	63H10	63I10	07J10	07K10	07L10	07M10	08N10	08O10	08P10	09Q10	09R10	09S10	10T10
12/500	-	63D12	63E12	63F12	07G12	07H12	07I12	07J12	08K12	08L12	08M12	08N12	09O12	09P12	09Q12	10R12	10S12	10T12
14/429	63C14	63D14	07E14	07F14	07G14	07H14	07I14	08J14	08K14	08L14	08M14	09N14	09O14	09P14	10Q14	10R14	10S14	-
16/375	07C16	07D16	07E16	07F16	08G16	08H16	08I16	08J16	08K16	09L16	09M16	09N16	09O16	10P16	10Q16	-	-	-
18/333	07C18	07D18	07E18	08F18	08G18	08H18	08I18	09J18	09K18	09L18	09M18	10N18	10O18	10P18	-	-	-	-

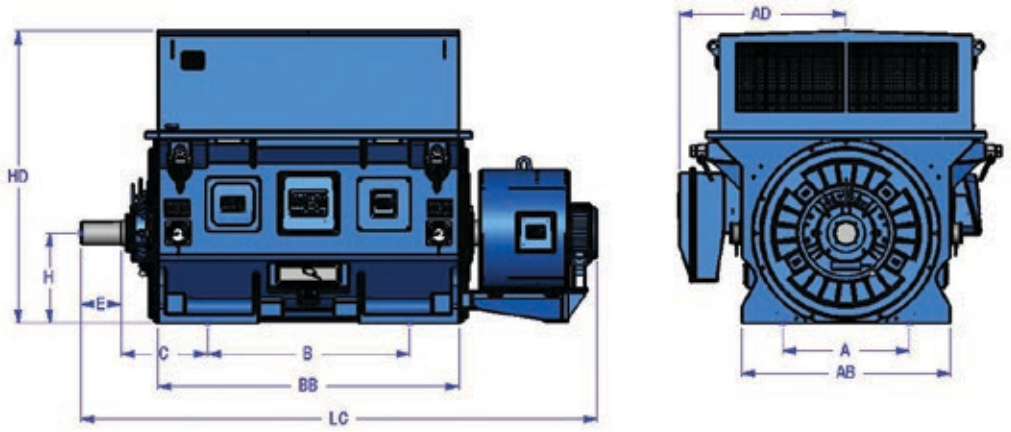
Types of Reference Hydrogenerators of the GH11 Line - 60 Hz

Output range code																			
Poles/rpm	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
8/900	-	-	-	-	-	-	-	63J08	63K08	63L08	07M08	07N08	07O08	07P08	08Q08	08R08	09S08	09T08	09U08
10/720	-	-	-	-	-	-	63I10	63J10	63K10	07L10	07M10	07N10	08O10	08P10	09Q10	09R10	09S10	09T10	10U10
12/600	-	-	-	63F12	63G12	63H12	07I12	07J12	07K12	07L12	08M12	08N12	08O12	08P12	09Q12	09R12	10S12	10T12	10U12
14/514	63C14	63D14	63E14	07F14	07G14	07H14	07I14	07J14	08K14	08L14	08M14	08N14	09O14	09P14	10Q14	10R14	10S14	10T14	-
16/450	63C16	63D16	07E16	07F16	07G16	07H16	08I16	08J16	08K16	08L16	08M16	09N16	09O16	09P16	10Q16	10R16	-	-	-
18/400	07C18	07D18	07E18	07F18	07G18	08H18	08I18	08J18	08K18	09L18	09M18	09N18	10O18	10P18	10Q18	-	-	-	-

GH10 and GH11 Lines

Typical Dimensions

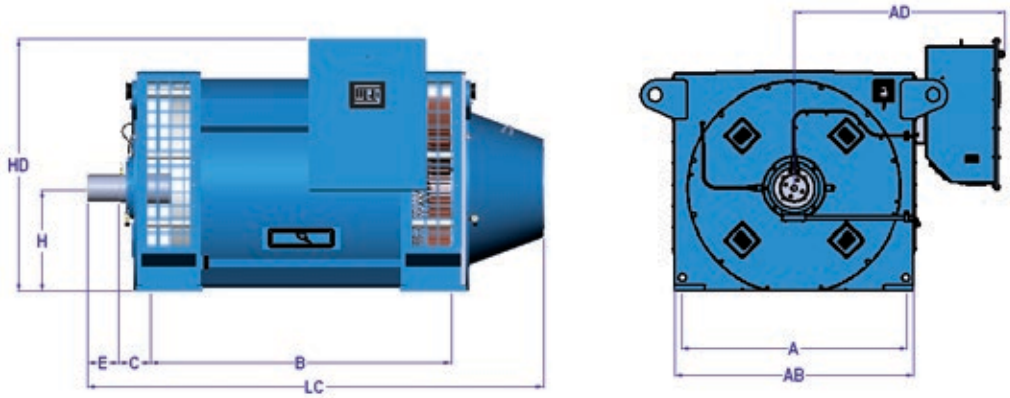
GH10 Line



Frame (IEC)	Dimensions (mm)									
	A	AB	AD[1]	B[2]	BB[2]	C[3]	E	H	HD	LC[4]
45 (450)	850	1,000	890	1,300	1,700	350-460	210	450	1,470	2,630-3,060
50 (500)	1,000	1,180	980-1,010	1,200-1,300	1,800-2,000	540-590	250	500	1,680	2,860-3,510
56 (560)	1,100	1,300	1,040-1,270	1,200-1,300	1,900-2,100	550-660	250	560	1,820	2,960-3,770
63 (630)	1,200	1,400	1,040-1,240	1,350-1,850	1,750-2,350	450-550	250	630	19,00	2,940-4,000

Notes: 1) According to the voltage: 400 V, 480 V, 3,300 V and 4,160 V;
2) According to the output;
3) According to the bearing type: rolling bearing and sleeve bearing;
4) According to the output and arrangement.

GH11 Line



Frame (IEC)	Dimensions (mm)									
	A	AB	AD[1]	B[2]	BB[2]	C[3]	E[3]	H	HD	LC[4]
63 (630)	1,160	1,400	1,230-2,000	1,760-1,910	2,030-2,140	240	170	630	1,360	3,000-3,075
07 (710)	1,300	1,600	1,340-2,100	1,920-2,090	2,160-2,330	260	230	710	1,530	3,300-3,450
08 (800)	1,600	1,850	1,450-2,250	1,835-2,275	2,125-2,565	285	250	800	1,700	3,250-3,700
09 (900)	1,750	2,000	1,525-2,375	1,950-2,470	2,260-2,780	320	280	900	1,905	3,450-3,900
10 (1000)	1,950	2,200	1,625-2,450	2,275-2,480	2,585-2,790	320	310	1,000	2,105	3,800-4,050

Notes: 1) According to the voltage: 400 V, 480 V, 3,300 V, 4,160 V, 6,300 V, 6,600 V, 11,000 V and 13,800 V;
2) According to the output;
3) According to the bearing type: rolling bearing;
4) According to the output and arrangement.

SH11 Line

The SH11 line is a compact and rugged hydrogenerator line designed to meet the different application demands of/turbine + hydrogenerator arrangements. The SH11 line was designed to improve the electrical and mechanical features allowing the generator to operate with higher inertia loads in a compact design, meet higher hydraulic loads and withstand adverse conditions such as load rejection or high runaway speeds without losing the reliability of WEG products.

Range of Application

The SH11 line can be supplied with the following technical data:

- Output range: 1,400 kVA to 18,000 kVA
- Number of poles: 8 to 36
- Rated voltage: 3,300 V to 11,000 V for 50 Hz
  4,160 V to 13,800 V for 60 Hz

Note: other voltages upon request.

Power ranges were established for the development of the SH11 line, each one corresponding to one hydrogenerator and providing the respective reference code. Table 3 shows the full application range of the SH11 line.

SH11							
Code	Output range (kVA)	3, 300 V / 50 Hz	4,160 V / 60 Hz	6,600 V / 50 Hz	6,900 V / 60 Hz	11,000 V / 50 Hz	13,800 V / 60 Hz
C	>1,000≤1,400	•	•	•	•		
D	>1,400≤1,600	•	•	•	•		
E	>1,600≤1,800	•	•	•	•		
F	>1,800≤2,000	•	•	•	•		
G	>2,000≤2,250	•	•	•	•		
H	>2,250≤2,500	•	•	•	•		
I	>2,500≤2,800	•	•	•	•		
J	>2,800≤3,150	•	•	•	•		
K	>3,150≤3,550	•	•	•	•		
L	>3,550≤4,000	•	•	•	•		
M	>4,000≤4,500	•	•	•	•		
N	>4,500≤5,000	•	•	•	•		
O	>5,000≤5,600	•	•	•	•		
P	>5,600≤6,300	•	•	•	•		
Q	>6,300≤7,100					•	•
R	>7,100≤8,000					•	•
S	>8,000≤9,000					•	•
T	>9,000≤10,000					•	•
U	>10,000≤11,200					•	•
V	>11,200≤12,500					•	•
W	>12,500≤14,000					•	•
X	>14,000≤16,000					•	•
Y	>16,000≤18,000					•	•

Table 3 - Application range of the SH11 line

SH11 Line

Types of Reference Hydrogenerators of the SH11 Line - 50 Hz

Output range code																							
Poles/rpm	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y	Z
8/750	-	-	-	-	-	-	-	-	-	07L08	07M08	07N08	07O08	08P08	08Q08	09R08	09S08	09T08	10U08	10V08	11X08	11Y08	11Z08
10/600	-	-	-	-	-	-	-	07J10	07K10	07L10	07M10	08N10	08O10	08P10	09Q10	09R10	09S10	10T10	10U10	11V10	11X10	11Y10	12Z10
12/500	-	-	-	-	07G12	07H12	07I12	07J12	08K12	08L12	08M12	08N12	09O12	09P12	09Q12	10R12	10S12	10T12	10U12	11V12	11X12	12Y12	12Z12
14/429	-	-	07E14	07F14	07G14	07H14	07I14	08J14	08K14	08L14	08M14	09N14	09O14	09P14	10Q14	10R14	10S14	11T14	11U14	12V14	12X14	12Y14	14Z14
16/375	07C16	07D16	07E16	07F16	08G16	08H16	08I16	08J16	08K16	09L16	09M16	09N16	09O16	10P16	10Q16	11R16	11S16	11T16	12U16	12V16	14X16	14Y16	16Z16
18/333	07C18	07D18	07E18	08F18	08G18	08H18	08I18	09J18	09K18	09L18	09M18	10N18	10O18	10P18	11Q18	11R18	12S18	12T18	14U18	14V18	16X18	16Y18	16Z18
20/300	08C20	08D20	08E20	09F20	09G20	09H20	09I20	09J20	10K20	10L20	10M20	10N20	11O20	11P20	12Q20	12R20	12S20	14T20	14U20	16V20	16X20	16Y20	16Z20
22/273	08C22	09D22	09E22	09F22	10G22	10H22	10I22	10J22	10K22	11L22	11M22	11N22	11O22	11P22	12Q22	12R22	14S22	14T22	16U22	16V22	18X22	18Y22	18Z22
24/250	08C24	09D24	09E24	09F24	10G24	10H24	10I24	10J24	11K24	11L24	11M24	11N24	12O24	12P24	12Q24	14R24	14S24	16T24	16U24	16V24	18X24	18Y24	18Z24
26/231	09C26	09D26	09E26	10F26	10G26	10H26	10I26	11J26	11K26	11L26	12M26	12N26	12O26	14P26	14Q26	16R26	16S26	16T26	16U26	18V26	18X26	18Y26	-
28/214	09C28	09D28	10E28	10F28	10G28	10H28	11I28	11J28	11K28	11L28	12M28	12N28	12O28	14P28	16Q28	16R28	16S28	16T28	18U28	18V28	18X28	-	-
30/200	10C30	10D30	10E30	10F30	11G30	11H30	11I30	11J30	12K30	12L30	12M30	12N30	14O30	14P30	16Q30	16R30	16S30	18T30	18U30	18V30	-	-	-
32/188	10C32	10D32	11E32	11F32	11G32	11H32	11I32	12J32	12K32	12L32	14M32	14N32	14O32	16P32	16Q32	16R32	18S32	18T32	18U32	-	-	-	-
34/176	10C34	11D34	11E34	11F34	11G34	12H34	12I34	12J34	12K34	14L34	14M34	16N34	16O34	16P34	16Q34	18R34	18S34	18T34	-	-	-	-	-
36/167	11C36	11D36	11E36	11F36	12G36	12H36	12I36	12J36	14K36	14L36	14M36	16N36	16O36	16P36	18Q36	18R36	18S36	-	-	-	-	-	-

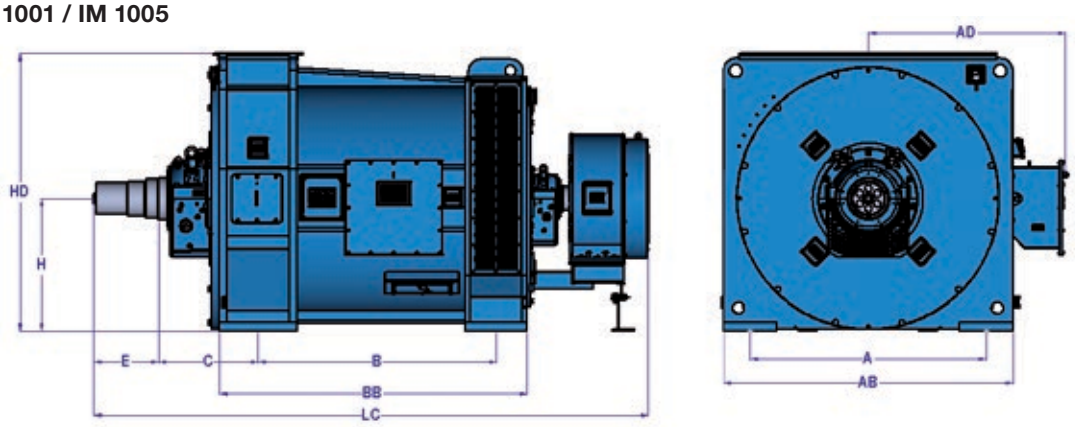
Types of Reference Hydrogenerators of the SH11 Line - 60 Hz

Output range code																							
Poles/rpm	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y	Z
8/900	-	-	-	-	-	-	-	-	-	-	07M08	07N08	07O08	07P08	08Q08	08R08	09S08	09T08	09U08	10V08	10X08	11Y08	11Z08
10/720	-	-	-	-	-	-	-	-	-	07L10	07M10	07N10	08O10	08P10	09Q10	09R10	09S10	09T10	10U10	10V10	11X10	11Y10	11Z10
12/600	-	-	-	-	-	-	07I12	07J12	07K12	07L12	08M12	08N12	08O12	08P12	09Q12	09R12	10S12	10T12	10U12	10V12	11X12	11Y12	12Z12
14/514	-	-	-	07F14	07G14	07H14	07I14	07J14	08K14	08L14	08M14	08N14	09O14	09P14	10Q14	10R14	10S14	10T14	11U14	11V14	12X14	12Y14	12Z14
16/450	-	-	07E16	07F16	07G16	07H16	08I16	08J16	08K16	08L16	08M16	09N16	09O16	09P16	10Q16	10R16	11S16	11T16	11U16	12V16	12X16	14Y16	14Z16
18/400	07C18	07D18	07E18	07F18	07G18	08H18	08I18	08J18	08K18	09L18	09M18	09N18	10O18	10P18	10Q18	11R18	11S18	11T18	12U18	14V18	14X18	16Y18	16Z18
20/360	08C20	08D20	08E20	08F20	08G20	09H20	09I20	09J20	09K20	09L20	10M20	10N20	10O20	11P20	11Q20	11R20	12S20	12T20	14U20	14V20	16X20	16Y20	16Z20
22/327	08C22	08D22	09E22	09F22	09G22	10H22	10I22	10J22	10K22	10L22	11M22	11N22	11O22	11P22	12Q22	12R22	14S22	14T22	14U22	16V22	16X22	18Y22	18Z22
24/300	08C24	08D24	09E24	09F24	09G24	10H24	10I24	10J24	10K24	11L24	11M24	11N24	11O24	12P24	12Q24	12R24	14S24	14T24	16U24	16V24	16X24	18Y24	18Z24
26/277	09C26	09D26	09E26	09F26	10G26	10H26	10I26	10J26	11K26	11L26	11M26	12N26	12O26	12P26	14Q26	14R26	14S26	16T26	16U26	16V26	18X26	18Y26	18Z26
28/257	09C28	09D28	09E28	10F28	10G28	10H28	10I28	11J28	11K28	11L28	11M28	12N28	12O28	12P28	14Q28	14R28	16S28	16T28	16U28	16V28	18X28	18Y28	-
30/240	09C30	10D30	10E30	10F30	10G30	10H30	11I30	11J30	11K30	11L30	12M30	12N30	12O30	14P30	16Q30	16R30	16S30	16T30	18U30	18V30	18X30	-	-
32/225	10C32	10D32	10E32	10F32	11G32	11H32	11I32	11J32	11K32	12L32	12M32	12N32	14O32	14P32	16Q32	16R32	16S32	18T32	18U32	18V32	-	-	-
34/212	10C34	10D34	10E34	11F34	11G34	11H34	11I34	12J34	12K34	12L34	14M34	14N34	14O34	14P34	16Q34	16R34	18S34	18T34	18U34	-	-	-	-
36/200	11C36	11D36	11E36	11F36	11G36	11H36	12I36	12J36	12K36	12L36	14M36	14N36	14O36	16P36	16Q36	16R36	18S36	18T36	-	-	-	-	-

SH11 line

Typical Dimensions

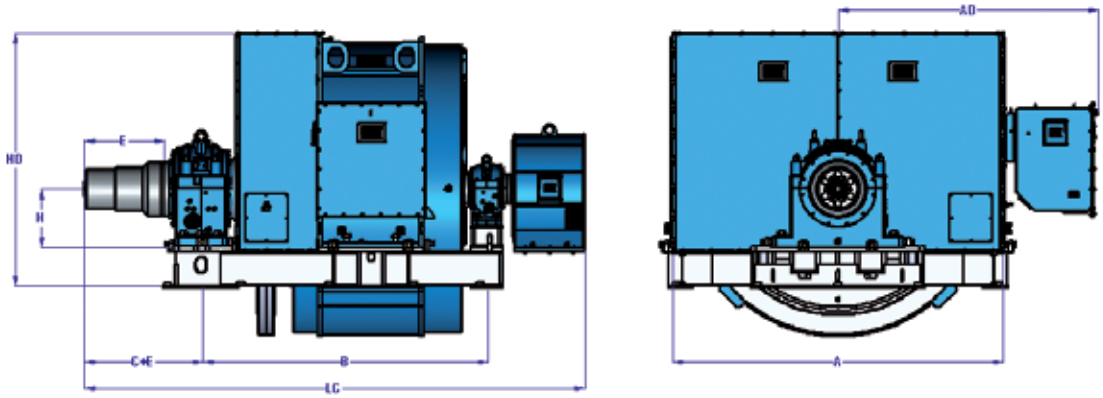
Mounting IM 1001 / IM 1005



Frame (IEC)	Dimensions (mm)									
	A	AB	AD[1]	B[2]	BB[2]	C[3]	E[3]	H	HD	LC[4]
07 (710)	1,700	2,000	1,650 - 2,000	1,430 - 2,330	2,050 - 2,600	900	400 - 1,000	900	1,905	3,600 - 4,600
08 (800)	1,860	2,200	1,750 - 2,100	1,530 - 2,440	1,700 - 2,550	1,000	400 - 1,000	1,000	2,100	3,400 - 4,800
09 (900)	2,070	2,450	1,900 - 2,250	1,800 - 2,530	2,000 - 2,800	1,120	400 - 1,000	1,120	2,340	3,900 - 5,300
10 (1000)	2,260	2,700	2,000 - 2,350	1,800 - 2,560	2,100 - 2,800	1,250	400 - 1,000	1,250	2,620	4,000 - 5,400

Notes: 1) According to the voltage: 3,300 V up to 13,800;
2) According to the output;
3) According to the arrangement: G, K or B;
4) According to the output and arrangement.

Mounting IM 7311 / IM 7315



Frame (IEC)	Dimensions (mm)							
	A	AD[1]	B[2]	C + E[3]	E[3]	H[5]	HD[5]	LC[4]
08 (800)	2,450	1,875-2,225	2,300-3,000	650-1,300	100-500	375-600	1,550-1,775	3,900-5,350
09 (900)	2,650	1,975-2,325	2,400-3,100	650-1,300	100-500	375-600	1,670-1,895	3,900-5,350
10 (1000)	2,950	2,125-2,475	2,600-3,200	730-1,450	100-500	375-600	1,780-2,005	4,000-5,500
11 (1120)	3,200	2,250-2,600	2,700-3,450	730-1,450	100-500	375-670	1,900-2,195	4,100-5,600
12 (1250)	3,450	2,450-2,800	3,000-3,450	730-1,450	100-500	375-670	2,050-2,345	4,300-5,600
14 (1400)	3,700	2,550-2,900	3,300-3,550	850-1,550	100-500	375-670	2,160-2,455	5,000-6,000
16 (1800)	4,200	2,800-3,150	3,300-3,500	850-1,550	100-500	375-670	2,395-2,670	5,000-6,000
18 (1800)	4,460	3,950-4,300	3,500-3,600	850-1,550	100-500	375-670	2,150-2,805	5,100-6,000

Notes: 1) According to the voltage: 6,900 V and 13,800 V;
2) According to the output;
3) According to the arrangement: G, K or B;
4) According to the output and arrangement;
5) According to the output, inertia, arrangement and axial loads.

SH11 Line

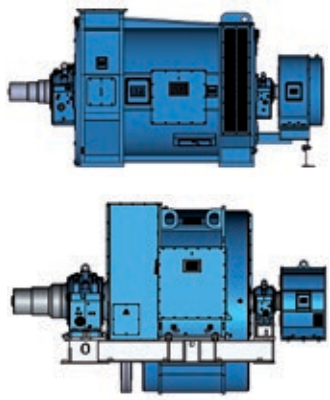
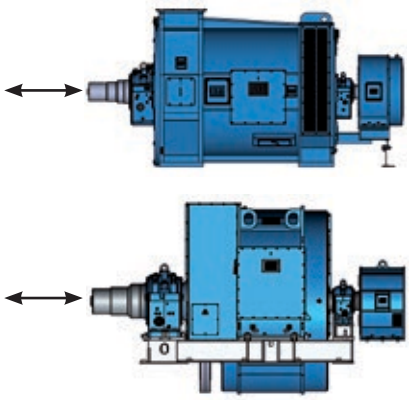
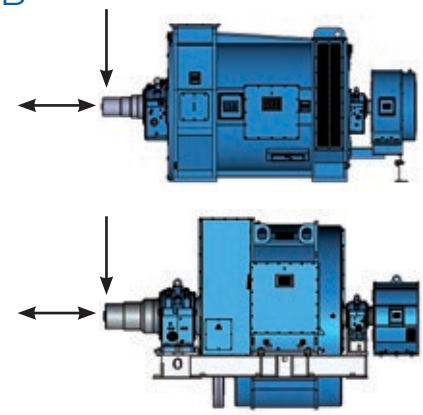
Turbine with own bearings		Turbine in balance
G	K	B
		

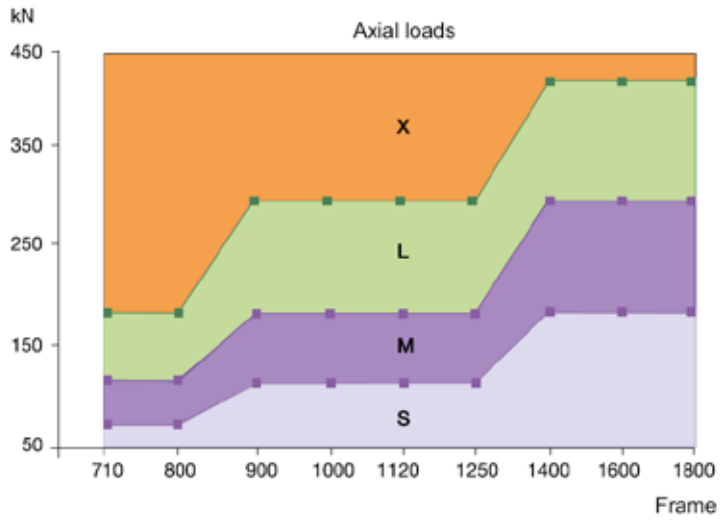
Table 4 - Possible bearing arrangements of the SH11 line

G - Hydrogenerator with guide bearing
K - Hydrogenerator with guide bearing and combined bearing. Axial efforts (typically for Kaplan turbine)
B - Hydrogenerator with guide bearing and combined bearing. Axial and radial efforts (typically for Francis or Pelton turbines)

Example: 11E36SK

Maximum Axial Loads

The SH11 line was designed for different applications/arrangements of the turbine and hydrogenerator. These differences result in distinct loads on the bearing following the trend of a uniform distribution between the axial and radial load according to the application (table 4).
Figure 1 allows a previous selection of the bearing considering the frame size and the axial effort. The correct selection of the bearings is not only based on the efforts on the bearing, but must also consider the mounting arrangement and the ease of maintenance.
There are direct relationships between the bearing x hydrogenerator dimensions, mainly for the bearings that are fixed in the hydrogenerator end shield.
The load intensity to be supported by the hydrogenerator bearings, as radial and/or axial loads, is directly related to turbine types and arrangements.
In order to minimize the problems caused by shaft deflection and to reduce eventual additional costs, the SH11 line was designed to operate with maximum deflection of 0.40 mm, with the exception of the Pelton type turbines that typically show higher deflection values.



N - Without axial loads
S - Low axial loads
M - Medium axial loads
L - High axial loads
X - Upon request

Example: 11E36SKM

Figure 1 - Axial loads

SH11 Line

Shaft End Deflection

Another important construction aspect to be considered for the correct design of the hydrogenerator is the shaft end deflection, mainly in the area of the mechanical shaft seal in the turbine shield.
If large shaft end deflections are present, the use of a special seal in the turbine is required to avoid a drop of the hydraulic performance of the turbine.
The shaft end deflection is directly related to the following factors:

- Hydraulic radial loads generated by the turbine
- Bearing arrangement (with turbine in balance or turbine with own bearings)
- Shaft dimensioning
- Selection of bearing size

Efficiency

The current need for a better use of energetic resources led WEG to develop new designs and manufacturing methods that resulted in higher efficiencies ensuring the SH11 line that meets the requirements of IEC 60034-1. The efficiency is determined as follows:

- The losses in the stator, rotor and damping windings are referenced at 95 °C
- The losses in the combined bearing are not considered in the final determination of the hydrogenerator efficiency but they must be informed separately
- As per standard, the informed losses (request the specific technical data sheet for each design) allow a measurement tolerance of 10%

Inertia

The SH11 line was designed with the purpose of improving the electrical and mechanical design allowing the generator to operate with higher inertia loads in compact types without losing the reliability and efficiency of WEG products.

Maximum Speed

Figure 2 shows the maximum speed (runaway speed) according to hydrogenerator rated speed.

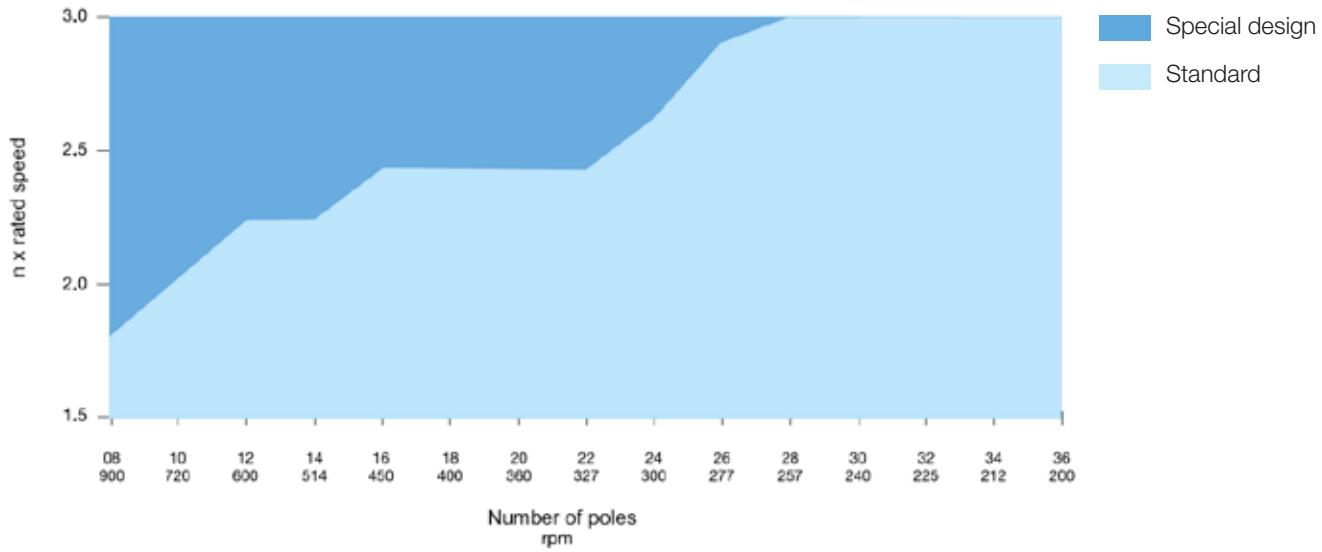
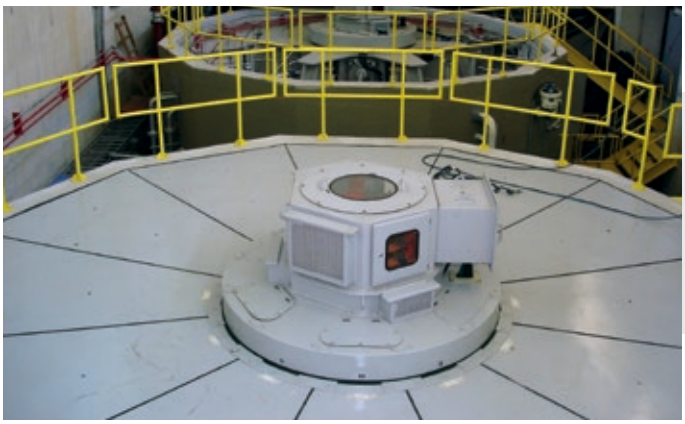


Figure 2 - Maximum speed according to rated speed

Applications

Customer: SHP RIO DO BRAÇO
Country: Brazil
6,600 kVA, 13,800 V, 8 poles,
frame size 900

Customer: NINHO DA ÁGUIA ENERGIA S.A.
Country: Brazil
5,560 kVA, 13,800 V, 8 poles,
frame size 900



Customer: AHE PICADA
Country: Brazil
27,800 kVA, 13,800 V, 16 poles,
frame size 2250

Customer: VA TECH HYDRO BRAZIL - RONDON II
Country: Brazil
27,220 kVA, 13,800 V, 24 poles,
frame size 2500

Services

WEG is able to restore existing medium and large electrical machines using the same technology that is used to manufacture motors and generators for inspection and restoration. The services are conducted in the field (at the customer's premises) or at two factories: Jaraguá do Sul Unit (Brazil) and the São Bernardo do Campo Unit (Brazil), which is also homologated to conduct services on equipment for use in explosive atmospheres. Those plants use the full structure and support of the engineering, industrial process and quality control departments, enabling fast, reliable and quality service.

Service of WEG products and other brands:
- DC generators and motors
- Three-phase induction motors (squirrel cage or slip ring; medium and high voltage)
- Synchronous motors (with or without brushes; medium and high voltage)
- Synchronous condensers
- Turbogenerators
- Hydrogenerators

WEG services: flexibility, agility and experience to optimize your time and productivity.

Spare Parts

After years in operation, generators need restoration to continue working properly.
For this restoration, we recommend that you use original spare parts supplied by the manufacturer. WEG team is available to promptly assist you in the correct identification of the component parts.

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