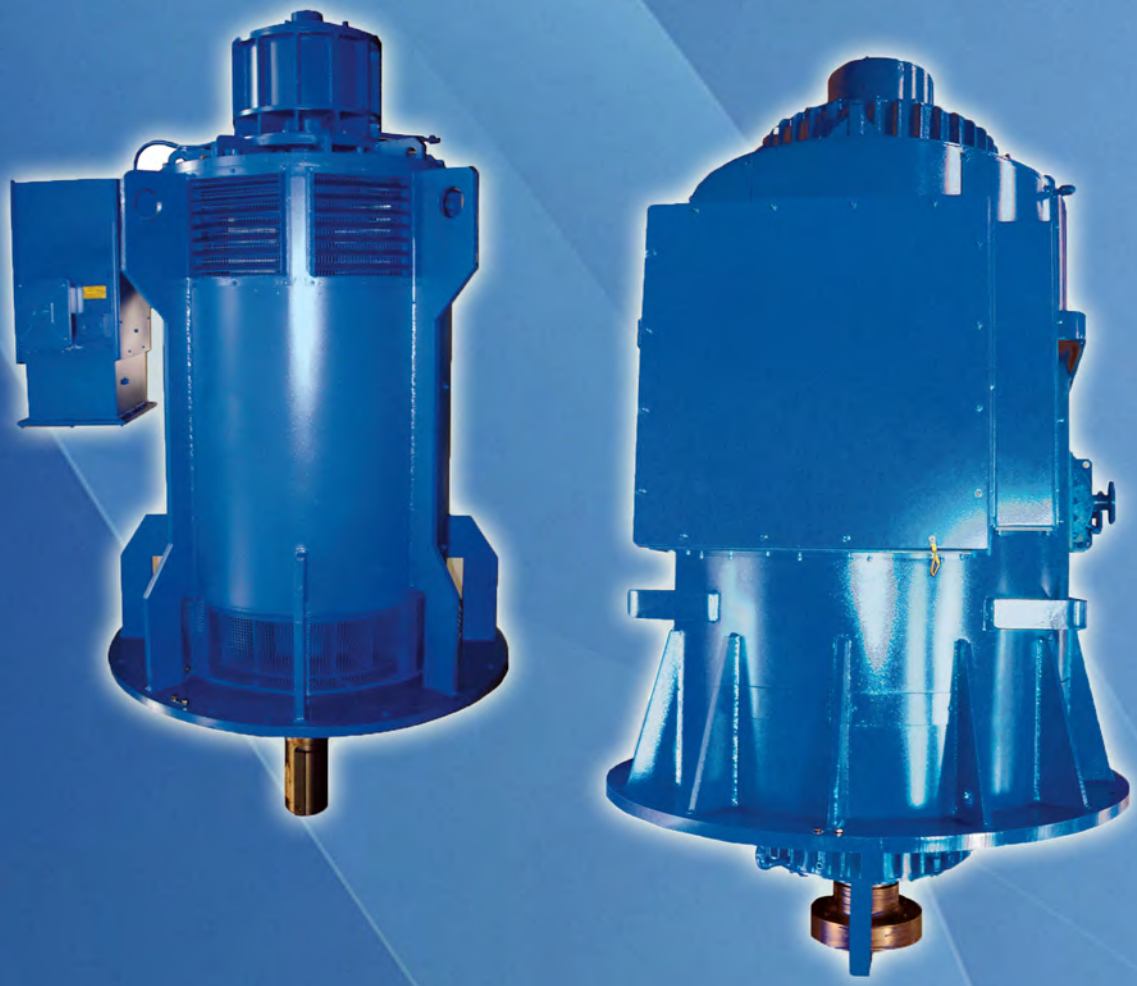
Ercole Marelli Power

Green Power Generation



HYDROPOWER PLANT GENERATORS

Ercole Marelli Power offers a wide range of solutions for hydropower applications. Our synchronous and asynchronous generators represent the best choice due to their certified quality, their versatile design allowing the generator to be customised to your needs, and to the experience acquired by more than 100 years of production. The undisputed quality proved by all **Ercole Marelli Power** products is shown by their high reliability, high efficiency and by their unchanged performance during many years
of service.
Ercole Marelli Power represents the best know-how within the hydropower field by ensuring our product has outstanding technical features.

RELIABILITY

- Long life endurance of electrical components and bearings.
- Class H insulation system for synchronous and class F for asynchronous generators. Impregnation with polyester resin using the Vacuum Pressure Impregnation (VPI) system. A further protection from any corrosion phenomenon is guaranteed by a tropicalization treatment.
- High safety factors to warrant the functionality of generators even in the worst working conditions.

HIGH PERFORMANCE

- Active parts are designed using the latest technologies and the best materials available in order to ensure high efficiency values.

SAFETY

- Space heaters are installed to avoid the risk of condensate inside generators.
- Bearings and stator windings temperatures are totally supervised by using a wide range of sensors.
- Synchronous generators can be equipped with electronic control devices for particular working conditions and to ensure real time monitoring.

TOTALLY CUSTOMISABLE

All generators are totally customisable.

- Nominal voltage from 380 to 6.600 V.
- From 4 to 18 poles; polarities not mentioned in the following pages might be available on request.
- Horizontal or vertical shaft.
- Degree of protection up to IP 55 using a heat exchanger.
- Runner directly connected to the generator shaft to avoid all the supports of the runner shaft.
- Bushings are used in strong hydraulic load applications to eliminate all the maintenance operations required by the rolling bearings.
- Use of flywheels to rise the proper inertial momentum of the generator.
- Wide set of control and adjustment devices (also with digital logic unit, if required) for synchronous generators.

FRAME SIZES 400 - 710 SYNCHRONUS GENERATORS: TECHNICAL FEATURES

STANDARDS

All generators are designed according to the IEC 60034-1, CEI EN 60034-1, BS 4999-5000, VDE 0530, NF 51-100, OVE M-10 and NEMA MG 1.22 standards and can be incorporated in the "CE" marked machinery.

AVAILABLE VOLTAGE

Generators can be supplied with the following voltage range:

- Low voltage (380 - 480 V)
- Medium voltage (3.000 - 6.600 V)

Voltages not listed can be supplied on request.

EXCITATION SYSTEM

Generators are self-excited through a brushless type excitation system.
The voltage is maintained within ± 0,5% of the nominal value in steady state conditions.
Generators are equipped with an auxiliary winding, or with the Varicomp overexcitement device, in order to supply a three-phase short circuit current 2,5 times greater than the nominal current of the generator.

OVERLOADS

The following overloads are permitted: 10% for one hour, 15% for ten minutes, 30% for four minutes and 50% for two minutes. All overloads must occur occasionally and must be followed by a minimum of one hour of running at nominal load or less.

OPERATING CONDITIONS

Parallel operation

All generators are provided with an oversized damper cage and are suitable for parallel operation with other generators, when equipped with a paralleling unit.
An automatic power factor regulator is available on request.

Environmental conditions

The rated outputs refer to an installation height up to 1.000 m asl and to a maximum ambient temperature of 40°C. For higher altitudes and different temperature values the rated outputs must be re-calculated using the factors listed in the following table.

Altitude [m asl]	Ambient temperature [°C]			
	30	40	45	50
1000	1.04	1.00	0.98	0.95
1500	1.03	0.97	0.95	0.92
2000	0.99	0.93	0.91	0.88
2500	0.95	0.90	0.88	0.86
3000	0.91	0.86	0.84	0.82

Power factor

The nominal power factor is 0,8 lagging. For different power factor values the following derating factors must be applied:

Power factor	1.0	+0.8	+0.7	+0.6	+0.5	+0.3	0
K	1.0	1.0	0.93	0.88	0.84	0.82	0.80

For negative power factors please contact Ercole Marelli Power.

DEGREE OF PROTECTION

Standard generators are air-cooled with an IP 23 degree of protection (IC 01 cooling type). Inlet and outlet air filters (IC 01 cooling type) are available on request to upgrade the index to IP 44.

To obtain a higher index of protection (IP 44, IP 54) generators can be supplied with an air-to-water heat exchanger installed on the body of the machinery (IC 81W cooling type).

SHAFT ORIENTATION

Generators are supplied with a horizontal (IM B3) or vertical (IM V10) shaft configuration. The vertical generators are equipped with a thrust bearing on the nodrive-end (NDE) side.

BEARINGS

Standard generators are supplied with grease-lubricated rolling bearings. All bearings are oversized to guarantee a minimum lifetime of 100.000 h (L10h = 100.000h), value obtained concerning to an unloaded standard shaft. The NDE bearing is conveniently insulated (*) to avoid shaft currents.

RUNNER DIRECTLY CONNECTED TO THE SHAFT

Generators can be equipped with a special shaft extension to directly connect the hydraulic turbine runner. In this configuration all bearings and the shaft are designed to withstand to axial and radial loads caused by the hydraulic thrust and by the weight of the runner. Depending on the loads applied and on the runaway speed of the runner, generators can be supplied with oil-lubricated rolling bearings or sleeve bearings.

ROTOR BALANCING

Rotors are dynamically balanced with a half key applied to the shaft extension in accordance with IEC 60034-14 to vibration grade normal (N) in standard execution. Generators can be supplied with reduced (R) or special (S) vibration levels on request.

INSULATION

Class H standard insulation system allows a maximum winding temperature rise of 125^{o}C referring to an ambient temperature of 40^{o}C. Windings are impregnated with polyester resin using the latest technology (VPI system). An enamel insulator (tropicalization treatment) coats all inner parts of the generator in order to protect it from corrosion.

TEMPERATURE SENSORS

Generators are equipped with three PT100 temperature sensors (one for each phase) installed into the slots to supervise the stator winding temperature and with a PT100 for each bearing to monitor its temperature (**). To control inlet and outlet air temperature of the air-to-water heat exchanger, PT100's are installed both on the NDE side and on the drive-end (DE) side on request. If the air-to-water heat exchanger is installed, PT100's are used to control the inlet and outlet water temperature.

FLYWHEEL

When the requested inertial momentum is higher than the actual inertial momentum of the generator, it is possible to extend the shaft on the NDE side in order to connect a flywheel.

TERMINAL BOXES

Generators are supplied with terminal boxes of appropriate dimensions in order to allow easy connection to the main leads. All generators allow the connection to the main leads and to the star point.
Two different terminal boxes, one for the star point and one for the leads for the auxiliary devices, are available on request.
Generators can be equipped with current transformers both on the main leads and the star point leads. The standard degree of protection for terminal boxes is IP 44; the IP 55 can be installed on request.

EQUIPMENT

Standard

- Class H insulation
- VPI impregnation type
- Windings protected from corrosion (tropicalization)
- Six leads stator winding into the terminal box
- Parallel device between generators
- N°3 PT100 into the stator winding
- N°1 PT100 for each bearing (**)
- Anti-condensation thermal heaters
- IP 23 degree of protection
- IP 44 degree of protection for the terminal box
- Bearings: more than 100.000 h lifetime
- NDE side bearing insulated to avoid shaft currents (*)

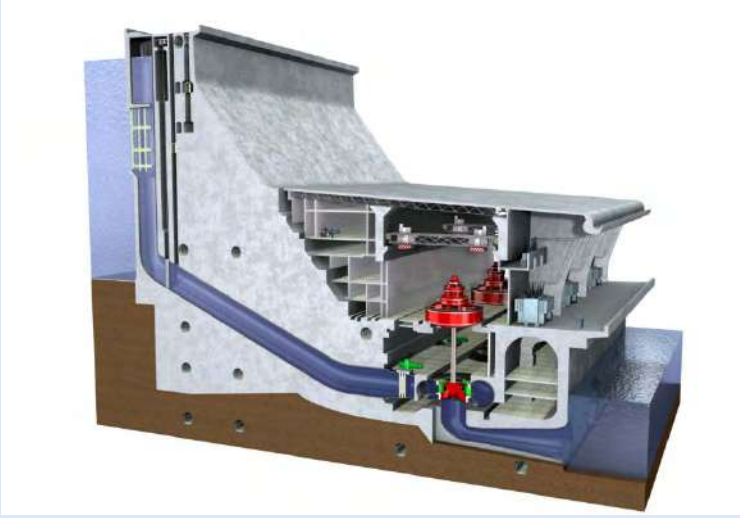
(*) for frame sizes 400 and 500 with 4 and 6 poles on request
(**) for 400 frame size on request

Electric options

- Automatic power factor regulator
- Rheostat for voltage remote control
- Manual excitation device
- Excitement control
- Diode failure monitor
- Digital AVR
- In-terminal-box measurement transformers
- Encoder
- Tachometric dynamo

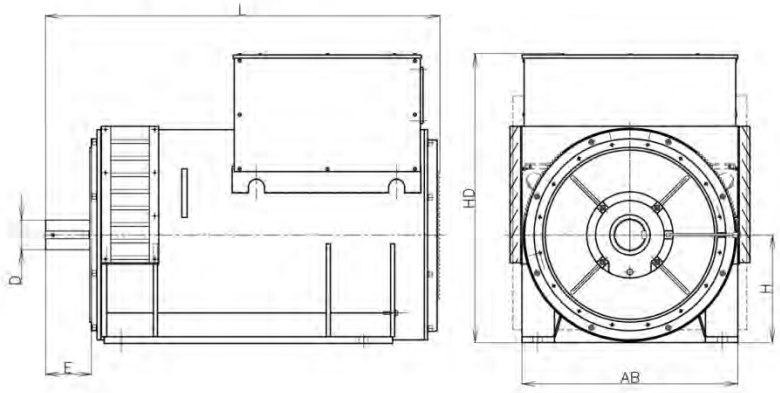
Mechanical options

- Inlet and outlet air filters (IP 44)
- Air-to-fresh water heat exchanger top mounted on generator
- IP 55 terminal box
- Star-point in separate terminal box
- Auxiliary leads into a separate terminal box
- Runner directly connected to the shaft of the generator
- Sleeve bearings
- Shaft extension
- Flywheel
- Arrangement for speed sensors
- Brush connection with rotor for earth fault detection
- Arrangement for vibration sensors into bearing box

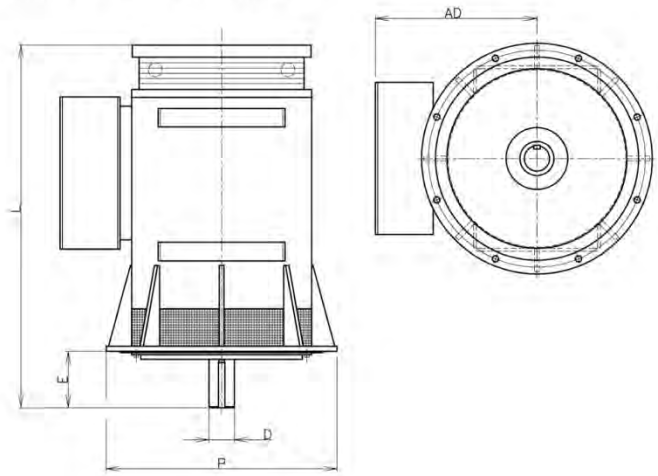


SYNCHRONOUS GENERATORS / OVERALL DIMENSIONS [mm]

Mounting: IM B3 - Air cooled (IC01)



Mounting: IM V10 - Air cooled (IC01)



Horizontal - Air Cooled

4 Poli 400V @ 50 Hz - 1500 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.8 - 1	400	1100	800	1760
1 - 1.1	450	1190	900	1807
1.1 - 1.3	450	1190	900	1987
1.3 - 1.5	500	1370	1000	1920
1.5 - 1.7	500	1370	1000	2170
1.7 - 2	500	1370	1000	2270
2 - 2.2	560	1430	1100	2305
2.2 - 2.5	560	1430	1100	2405
2 - 2.4	630	1580	1280	2150
2.2 - 2.6	630	1580	1280	2350
2.4 - 2.8	630	1580	1280	2450

6 Poli 400V @ 50 Hz - 1000 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.9 - 1.1	500	1370	1000	1920
1.1 - 1.3	500	1370	1000	2170
1.3 - 1.5	500	1370	1000	2270
1.4 - 1.6	560	1430	1100	2305
1.6 - 1.9	560	1430	1100	2405
1.5 - 1.7	630	1580	1280	2150
1.7 - 2.1	630	1580	1280	2350
2.1 - 2.4	630	1580	1280	2450
2.2 - 2.6	710	1880	1500	2450
2.6 - 2.9	710	1880	1500	2650

8 Poli 400V @ 50 Hz - 750 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.9 - 1	500	1370	1000	2170
1 - 1.2	500	1370	1000	2270
1.1 - 1.3	560	1430	1100	2305
1.3 - 1.5	560	1430	1100	2405
1.1 - 1.3	630	1580	1280	2150
1.3 - 1.6	630	1580	1280	2350
1.7 - 2	630	1580	1280	2450
2 - 2.3	710	1880	1500	2450
2.3 - 2.6	710	1880	1500	2650
2.6 - 2.9	710	1880	1500	2650

Vertical - Air Cooled

4 Poli 400V @ 50 Hz - 1500 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.8 - 1	1000	700	1940
1 - 1.1	1150	740	2030
1.1 - 1.3	1150	740	2210
1.3 - 1.5	1250	780	2250
1.5 - 1.7	1250	780	2500
1.7 - 2	1250	780	2600
2 - 2.2	1400	700	2340
2.2 - 2.5	1400	700	2440
2 - 2.4	1600	1225	2430
2.2 - 2.6	1600	1225	2630
2.4 - 2.8	1600	1225	2730

6 Poli 400V @ 50 Hz - 1000 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.9 - 1.1	1250	780	2250
1.1 - 1.3	1250	780	2500
1.3 - 1.5	1250	780	2600
1.4 - 1.6	1400	700	2340
1.6 - 1.9	1400	700	2440
1.5 - 1.7	1600	1225	2430
1.7 - 2.1	1600	1225	2630
2.1 - 2.4	1600	1225	2730
2.2 - 2.6	1800	1150	2470
2.6 - 2.9	1800	1150	2670

8 Poli 400V @ 50 Hz - 750 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.9 - 1	1250	780	2500
1 - 1.2	1250	780	2600
1.1 - 1.3	1400	700	2340
1.3 - 1.5	1400	700	2440
1.1 - 1.3	1600	1225	2430
1.3 - 1.6	1600	1225	2630
1.7 - 2	1600	1225	2730
2 - 2.3	1800	1150	2470
2.3 - 2.6	1800	1150	2670
2.6 - 2.9	1800	1150	2770

Horizontal - Air Cooled

4 Poli 3000V @ 50 Hz - 1500 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.9 - 1.2	450	1190	900	1987
1.1 - 1.5	500	1370	1000	2170
1.5 - 1.7	500	1370	1000	2270
1.7 - 2	560	1430	1100	2305
2 - 2.3	560	1430	1100	2405
1.5 - 1.7	630	1580	1280	2150
1.8 - 2.3	630	1580	1280	2350
2.3 - 3.1	630	1580	1280	2450

6 Poli 3000V @ 50 Hz - 1000 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
1 - 1.1	500	1370	1000	2270
1.5 - 1.7	560	1430	1100	2305
1.7 - 1.9	560	1430	1100	2405
1.1 - 1.3	630	1580	1280	2150
1.4 - 1.9	630	1580	1280	2350
1.9 - 2.1	630	1580	1280	2450
1.9 - 2.2	710	1880	1500	2450
2.5 - 3	710	1880	1500	2650
2.8 - 3.7	710	1880	1500	2650

8 Poli 3000V @ 50 Hz - 750 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.8 - 1.1	500	1370	1000	2270
1.1 - 1.3	560	1430	1100	2305
1.3 - 1.5	560	1430	1100	2405
1 - 1.1	630	1580	1280	2150
1.1 - 1.3	630	1580	1280	2350
1.3 - 1.7	630	1580	1280	2450
1.7 - 2	710	1880	1500	2450
2.2 - 3	710	1880	1500	2650
3 - 3.3	710	1880	1500	2650

Vertical - Air Cooled

4 Poli 3000V @ 50 Hz - 1500 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.9 - 1.2	1250	780	2250
1.1 - 1.5	1250	780	2500
1.5 - 1.7	1250	780	2600
1.7 - 2	1400	700	2340
2 - 2.3	1400	700	2440
1.5 - 1.7	1600	1225	2430
1.8 - 2.3	1600	1225	2630
2.3 - 3.1	1600	1225	2730

6 Poli 3000V @ 50 Hz - 1000 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
1 - 1.1	1250	780	2500
1.5 - 1.7	1250	780	2600
1.7 - 1.9	1400	700	2340
1.1 - 1.3	1400	700	2440
1.4 - 1.9	1600	1225	2430
1.9 - 2.1	1600	1225	2630
1.9 - 2.2	1600	1225	2730
2.5 - 3	1800	1150	2470
2.8 - 3.7	1800	1150	2670

8 Poli 3000V @ 50 Hz - 750 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.8 - 1.1	1250	780	2600
1.1 - 1.3	1400	700	2340
1.3 - 1.5	1400	700	2440
1 - 1.1	1600	1225	2430
1.1 - 1.3	1600	1225	2630
1.3 - 1.7	1600	1225	2730
1.7 - 2	1800	1150	2470
2.2 - 3	1800	1150	2670
3 - 3.3	1800	1150	2770

Horizontal - Air Cooled

4 Poli 6000V @ 50 Hz - 1500 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.9 - 1.1	450	1190	900	1987
1.1 - 1.3	500	1370	1000	2170
1.3 - 1.5	500	1370	1000	2270
1.5 - 1.8	560	1430	1100	2305
1.8 - 2	560	1430	1100	2405
1.4 - 1.6	630	1580	1280	2150
1.6 - 2.1	630	1580	1280	2350
2.1 - 2.8	630	1580	1280	2450

6 Poli 6000V @ 50 Hz - 1000 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
0.9 - 1	500	1370	1000	2270
1.3 - 1.5	560	1430	1100	2305
1.5 - 1.7	560	1430	1100	2405
1 - 1.2	630	1580	1280	2150
1.3 - 1.7	630	1580	1280	2350
1.6 - 2	630	1580	1280	2450
1.7 - 2	710	1880	1500	2450
2 - 2.7	710	1880	1500	2650
2.7 - 3.4	710	1880	1500	2650

8 Poli 6000V @ 50 Hz - 750 rpm				
	DIMENSIONI			
Potenza MVA	H	HD	AB	L
1.1 - 1.2	560	1430	1100	2305
1.2 - 1.4	560	1430	1100	2405
0.9 - 1	630	1580	1280	2150
1 - 1.2	630	1580	1280	2350
1.2 - 1.5	630	1580	1280	2450
1.5 - 1.8	710	1880	1500	2450
2 - 2.6	710	1880	1500	2650
2.6 - 3	710	1880	1500	2650

Vertical - Air Cooled

4 Poli 6000V @ 50 Hz - 1500 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.9 - 1.1	1250	780	2250
1.1 - 1.3	1250	780	2500
1.3 - 1.5	1250	780	2600
1.5 - 1.8	1400	700	2340
1.8 - 2	1400	700	2440
1.4 - 1.6	1600	1225	2430
1.6 - 2.1	1600	1225	2630
2.1 - 2.8	1600	1225	2730

6 Poli 6000V @ 50 Hz - 1000 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
0.9 - 1	1250	780	2500
1.3 - 1.5	1250	780	2600
1.5 - 1.7	1400	700	2340
1 - 1.2	1400	700	2440
1.3 - 1.7	1600	1225	2430
1.6 - 2	1600	1225	2630
1.7 - 2	1600	1225	2730
2 - 2.7	1800	1150	2470
2.7 - 3.4	1800	1150	2670

8 Poli 6000V @ 50 Hz - 750 rpm			
	DIMENSIONI		
Potenza MVA	P	AD	L
1.1 - 1.2	1400	700	2340
1.3 - 1.5	1400	700	2440
1 - 1.1	1600	1225	2430
1.1 - 1.3	1600	1225	2630
1.3 - 1.7	1600	1225	2730
1.7 - 2	1800	1150	2470
2.2 - 3	1800	1150	2670
3 - 3.3	1800	1150	2770