



## Difgen specifications



The Difgen is delivered as a complete operational system, ready for grid connection and start-up. A power meter will normally be supplied by the grid owner. If extra grid protection is required, an optional grid protection unit (eg, G59 in the UK) can be delivered.

The Difgen comes with two main components: the control power module (CPM) and the turbine generator module (TGM). The TGM is delivered with the turbine and generator on a skid frame, ready for installation. Flange adapters are delivered with the required PN/DN class for simple installation.

## Configurations

MODEL	Flow rate min-max [l/s]		Max inlet pressure [bar] 1)	Max diff. pressure [bar]	Max diff. pressure 10-pole gen	Min operat. diff. pressure
DG13-14	7	35	14	10	N/A	1.5
DG13-21	11	53	12	10	N/A	1.5
DG13-28	15	70	10	8	N/A	1
DG18-13	15	70	16	10	N/A	1.5
DG18-18	21	100	14	10	N/A	1.5
DG18-26	30	140	12	9	10	1.5
DG18-36	45	200	10	6.2	7.2	1
DG18-52	60	240	7	4.5	5	1
DG18-73	85	300	4	2.8	3	1
DG18-13L	15	70	13	13	N/A	1.5
DG18-18L	21	100	13	12	13	1.5
DG18-52HP	60	240	12	4.5	5	1
DG18-73HP	85	300	8	2.8	3	1

Note: Max flow limitations might apply for 10-pole generator systems.

## Physical properties TGM

MODEL	H (mm)	W (mm)	D (mm)	Weight (kg)	Standard flange
DG13-14	2 000	950	1 150	1 500	DN125/PN16
DG13-21	2 200	950	1 150	1 700	DN150/PN16
DG13-28	2 400	950	1 150	2 200	DN150/PN16
DG18-13	2 000	950	1 150	1 500	DN150/PN16
DG18-18	2 200	950	1 150	1 700	DN150/PN16
DG18-26	2 400	950	1 150	2 200	DN200/PN16
DG18-36	2 400	950	1 150	2 600	DN250/PN16
DG18-52/52HP	2 700	950	1 150	3 000	DN250/PN16
DG18-73/73HP	2 900	1 016	1 150	3 500	DN350/PN16
DG18-13L	2 400	1 016	1 150	2 200	DN150/PN25
DG18-18L	2 400	1 016	1 150	2 600	DN150/PN16

## Mains connection

ITEM	VALUES	COMMENTS
Mains power	Up to 110kW	Depends on voltage range and inverter sizes
Mains voltage	380-500V	
Mains frequency	50 or 60Hz	
Phases	Requires three phases	
Power factor	cos1= 1 (fundamental)/cos = 0.99 (total)	
Power quality	Built-in LCL filter	For distortion-free regenerative operation

1) Limitations apply. Seal mean pressure must not exceed 10 bar during operation. Formula for seal mean pressure:

- $(\text{inlet pressure} + \text{outlet pressure})/2$  - for all Difgen models except L models
- $(\text{inlet pressure} + \text{outlet pressure} + (\text{inlet pressure} - \text{outlet pressure}/2))/2$  - for L models

### Certifications

ITEM	VALUES
Distributed generation	IEEE 1547 UL1741 G59
CE markings	Machine EMC Low voltage
Electric safety	UL 508
Electromagnetic compatibility	EN 61800-3
Drinking water compatibility	ANSI 61/ DWI

### Physical properties CPM

Depth	600mm
Width	600mm
Height	2 000mm
Weight	350kg
Cabinet colour	RAL 7035



### Standard scope

#	Item	Description
1	VFD	Variable regenerative frequency drive. Output 230-690V (limitations on current for some models, check for each site. Transformer might be required), 3 phase, 50/60Hz output
2	Flange adapter	Standard flange adaptor from turbine to pipe
2	Pressure transmitters	Measurement sensor for pressure control. Sensors pressure ranges are specified to meet site parameters (code alternatives _IOx)
1	Turbine	Rotating lobe turbine
1	Generator	To be specified for each site. Forced ventilation fan included.
1	Cabinet	Enclosure for electrical equipment excluding generator
1	HMI touch screen	10inch colour touch screen operator panel in front door (CPM Solo only)
1	Skid	Generator and turbine mounted on a skid
2	Buffer chamber canisters	Including pressure gauges for pressurised buffer chambers
1	Basic logging	Web access to basic performance parameters (pressures, flow rate, kW, kWh, CO2 savings, status). Client is responsible for internet access (DMZ, GPRS modem or equivalent)
1	Backup battery	CPM battery backup - 7Ah (CPM Solo only)
1	Documentation	Installation and commissioning manual (MAN1016) O&M manual (MAN1000) <ul style="list-style-type: none"> <li>▪ Certificates</li> <li>▪ Conformity of materials</li> <li>▪ Approvals</li> </ul> Communications manual (MAN1019) Standard CPM drawings (DRW0162 or DRW0166) <ul style="list-style-type: none"> <li>▪ Schematic diagrams of CPM</li> <li>▪ Dimensional drawings</li> <li>▪ Interface wiring diagram</li> </ul> Dimensional drawings of TGM System specification for delivered system (SPCxxxxx) Test reports

### Environment

ITEM	VALUES	COMMENTS
Ambient temperature operating	0 to 30°C [32 to 86°F]	
Ambient temperature storage	-20 to 70°C [-4 to 158°F]	Must be fully drained of water if ambient temperature is below freezing
Ambient temperature transport	-20 to 70°C [-4 to 158°F]	No condensation allowed
Relative humidity	5 to 85%	Without derating
Altitude	0 to 2 000m above sea level	Derating (1% /100m) above 1 000m

# Options and alternatives - TGM

Ordering code: TGMxx-xx\_Gxx\_Axx\_Pxx\_lxx+(sequence of options)

Name	Description	Delivery time	Code
Model name	E.g. TGM18-52	N/A	TGMxx-xx
Generator size	For internal Zeropex use. Difgen is a high-torque device, and generator is selection from max torque criteria - 37kW, 8-pole, 400V - 45kW, 8-pole, 400V - 55kW, 8-pole, 400V - 75kW, 8-pole, 400V - 90kW, 8-pole, 400V - 75kW, 8-pole, 500V - 90kW, 8-pole, 500V - 110kW, 8-pole, 500V - 75kW, 10-pole, 400V - 90kW, 10-pole, 400V - 75kW, 10-pole, 500V - 90kW, 10-pole, 500V - 110kW, 10-pole, 500V	All within standard delivery time	_G01 (alt) _G02 (alt) _G03 (alt) _G04 (alt) _G05 (alt) _G06 (alt) _G07 (alt) _G08 (alt) _G21 (alt) _G22 (alt) _G23 (alt) _G24 (alt) _G25 (alt)
IP 65 on generator	Upgrade from IP55 (standard) to IP65. Consists of an additional seal integrated into the generator to make it dust tight.	Within standard delivery time	+IP65 (opt)
Surface treatment	- Blue colour (RAL5002), TT 120 micrometer, 2K Paint system cat C3 (ISO12944) - Blue colour (RAL5002), TT 150 micrometer, 2K Paint system cat C4. Recommended if TGM is installed outdoors or in high humidity or corrosive areas. (ISO 12944-2).	Within standard delivery time	_P01 (std) _P02 (opt)
TGM Arrangements	In-line direct drive, horizontal. - Horizontal water inlet/outlet. Paint coated - Vertical water inlet/outlet (90 degree rotated turbine). Paint coated - Horizontal water inlet/outlet. Paint coated. Galvanized skid - Vertical water inlet/outlet (90 degree rotated turbine). Paint coated. Galvanized skid - Vertical water inlet/outlet (90 degree rotated turbine). Paint coated. 500mm elevated skid base.	_A01 to _A04 within standard delivery time  Add 4-6 weeks	_A01 (std) _A02 (opt)  _A03 (opt) _A04 (opt)  _A05 (opt)
Alternative flange adapters	Alternative flange sizes outside our standard range (ref. table physical properties TGM) - PN16/DN125 - PN16/DN150 - PN16/DN200 - PN16/DN250 - PN16/DN300 - PN16/DN350 - 150lbs, ANSI 6" - 150lbs, ANSI 10" - 150lbs, ANSI 14"	All within standard delivery time	+F01 (opt) +F02 (opt) +F03 (opt) +F04 (opt) +F05 (opt) +F06 (opt) +F50 (opt) +F51 (opt) +F52 (opt)
Special flange adapters	Special flange adapter for flange sizes outside our standard and option range range - on request	Add 2-4 weeks	+F99 (opt)
Pressure transmitters	Pressure transmitter range for inlet/outlet pressure - 6 bar - 10 bar - 16 bar - 25 bar	All within standard delivery time	_I01 (alt) _I02 (alt) _I03 (alt) _I04 (alt)
Block and bleed valves	Set of two block and bleed valves for pressure transmitters. Each consists of three manual valves mounted in a "Y" configuration. One outlet is available for connecting an external instrument. Mounted on the turbine flange connector, together with the pressure sensors. - 6 bar with block and bleed - 10 bar with block and bleed - 16 bar with block and bleed - 25 bar with block and bleed	All within standard delivery time	_I11 (opt) _I12 (opt) _I13 (opt) _I14 (opt)
Stainless steel housing for turbine	Stainless steel housing.	Add 8-10 weeks	On request
Wetted turbine parts in stainless steel.	All internal metal parts in contact with fluid are in stainless steel or corrosion-free material.	Add 8-10 weeks	On request
Extended pressure	Reinforced housing for extended pressure applications. Must be analyzed and confirmed by Zeropex prior to ordering	Add 8-10 weeks	+K01 (opt)

## Options and alternatives - TGM cont.

Name	Description	Delivery time	Code
Pressure transmitter (for pressurised buffer chambers only)	Set of two pressure transmitters for monitoring pressure in buffer chambers (one in each buffer chamber) connected to the Difgen system.	Within standard delivery time	+S01 (opt)
Bearing monitoring nodes	Four SPM measuring points for bearing diagnostics. Mobile diagnostic equipment must be brought to the site to measure and analyse. Ref. <a href="http://www.spminstrument.com">www.spminstrument.com</a> .	Within standard delivery time	+R01 (opt)
Bearing monitoring system	Data acquisition units for continuous monitoring of bearing conditions. Includes 4 - 20mA signals for interfacing to client's SCADA. Ref. <a href="http://www.spminstrument.com">www.spminstrument.com</a>	Delivered separately	+R02 (opt)
Difgen condition monitoring (temp)	Set of 2 temperature sensors (PT100) mounted on turbine. Used to measure surface temperature in gear box and QD cover. To be connected to suitable inputs at PLC, Difgen MC or similar.	Within standard delivery time	+M01 (opt)
Difgen condition monitoring (vibration)	Set of 2 vibration transmitters measuring overall machine vibration in X and Z direction. To be connected to suitable inputs at PLC, Difgen MC or similar.	Within standard delivery time	+M02 (opt)

## Options and alternatives - CPM

Ordering code: CPM\_FExx\_BEEx\_Pxx\_Vxx+(sequence of options)

Name	Description	Delivery time	Code
CPM Solo/Slave	CPM Solo or CPM Slave	N/A	_FE00_BE00 _FE01_BE01
Power	CPM Power rating (determined by load/torque analysis of operational conditions)	N/A	_Pxxx
Grid voltage	Grid voltage range - 380-415V - 380-500V	All within standard delivery time	_V01 (alt) _V02 (alt)
GPU G59	Grid protection unit/grid safety relay (UK:G59-2). Independent G59/EN60225 protection relay to trip supply circuit breaker - automatic reset	Within standard delivery time	+G01 (opt)
Special cabinet colour	Special cabinet colour. RAL7035 is standard	Add 1-2 weeks	+RALxxxx (opt)
IP/NEMA cabinet	Higher IP/NEMA protection of cabinet (from IP 43). High classes require water- cooled cabinet. Water connection by client	Add 4 - 6 weeks	On request
Transformer	Depending on configuration, site parameters and grid interconnection properties, a transformer might be required. Can also be used to isolate electric noise issues	Add 6-10 weeks	On request
Continuous control	Resistor load dump system for continuous gridloss operation. Includes cage for protection of resistive heat element. - 27kW continuous - 53kW continuous - 80kW continuous - 106kW continuous	Within standard delivery time Add 6-8 weeks Add 6-8 weeks	+CC01 (opt) +CC02 (opt) +CC03 (opt) +CC04 (opt)

**COMMUNICATION OPTIONS**

Name	Description	Delivery time	Code
Modbus ethernet for CPM Solo	Modbus TCP/IP interface. Hardware only included. Setup and configuration is client responsibility.	Within standard delivery time	+D01 (opt)
Modbus ethernet for CPM Slave	Modbus TCP/IP interface. Hardware only included. Setup and configuration is client responsibility.	Within standard delivery time	+D02 (opt)
Profibus DP Slave for CPM Solo	Profibus DP Slave. Hardware only included. Setup and configuration is client responsibility	Within standard delivery time	+D03 (opt)
Profibus DP Slave for CPM Slave	Profibus DP Slave. Hardware only included. Setup and configuration is client responsibility	Within standard delivery time	+D04 (opt)
Remote logging	3G Modem with top mounted antenna. (Only for CPM Solo)	Withing standard delivery time	+L01 (opt)

**GENERAL OPTIONS**

Name	Description	Delivery time
FAT	Extra day client-witnessed full-scale performance and functionality test in flow laboratory. Does not include client costs for eg. travel, accommodation, etc.	Within standard delivery time
SAT/commissioning support	Site acceptance test and commissioning support. Priced per day.	N/A
ZCE training	Please contact Zeropex.	N/A

## Configuration examples

**TGM18-36\_K0\_G24\_A03\_P02\_I02+F05+S01+M01+R01+IP65**

- TGM18-36
- \_K0: standard pressure rating for selected turbine
- \_G24: Generator size (internal use, determined by configuration): 110kW, 500V, 10 pole, IP55
- \_A03: Horizontal water inlet/outlet. Paint coated. Galvanized skid
- \_P02: Blue colour (RAL5002), TT 150 micrometer, 2K Paint system category C4
- \_I02: 10 bar pressure transmitter rating (0-10bar)
- +F05: PN16, DN300 flange adapter
- +S01: Buffer chamber monitoring by 2 pressure transmitters
- +M01: 2 x Temp. transmitters for turbine surface temperature
- +R01: 4 x fixed plugs for bearing condition monitoring
- +IP65: IP65 water ingress protection

**CPM\_FE01\_BE01\_P110\_V02+D04**

- CPM\_FE01\_BE01: CPM Slave (requires Difgen MC or other master control)
- \_P110: 110 kW power rating
- \_V02: 380 - 500 VAC grid voltage
- +D04: Profibus DP Slave for CPM Slave



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