

IEV'S PATENTED AND WORLD'S LOWEST COST

STRUCTURAL INTEGRITY MANAGEMENT (SIM) SOLUTION

MGP-*i* IS NOW CERTIFIED TYPHOON PROOF

TYPHOONS, CYCLONES AND HURRICANES

Typhoons are tropical storms that are prevailing in the North West Pacific oceans. Similar extreme sea conditions are present in the form of hurricanes in the North East Pacific and North Atlantic oceans, and tropical cyclones in Indian, Australia and South Pacific oceans. They pose serious threats to offshore oil and gas platforms located in these waters, mostly to the point of forcing shutdowns and/or causing significant damages. The degree of damage depends on the structural integrity and a critical factor that significantly increases the impact of such extreme sea conditions is the level of marine growth that is present in the wave zone of offshore installations.

PRODUCT DAMAGE IN EXTREME SEA CONDITIONS

In the last 30 years, IEV has installed its proprietary Marine Growth Preventers ("MGPs") on some 500 offshore facilities worldwide, targeted particularly on structural areas in the wave zone to maintain and/or enhance their structural integrity. Improvement in both Reserved Strength Ratio and fatigue life are achieved from the permanent prevention of marine fouling settlement in this critical zone. However, product damage were recorded in periods of extreme weather conditions such as the 2013 Pacific typhoon season and Cyclone Nargis in the Andaman Sea.

NECESSITY IS THE MOTHER OF INVENTION

At IEV, we challenge ourselves to continuously improve our technologies to meet customer requirements. Our response to the need to prevent marine fouling on an offshore platform that is subjected to impact from ice sheets led us to the development of our current generation of anti-impact and self-cleaning Marine Growth Preventers, known as MGP-*i*. The design of the product to withstand such extreme impact forces brings forth the generation of typhoon-proof MGPs.



A proprietary technology of IEV Group of Companies

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TESTING THE TYPHOON PROOF MGP-i

To measure the impact strength of the MGP-i, the product was put through a series of Drop-Tests validated by SGS, one of the global leaders in inspection, verification, testing and certification. The Single-Ring was tested with 20 drops from a height of 20 meters and the Multiple-Ring was tested with 5 drops from a height of 10 meters without breakage.

The tests concluded that IEV's Typhoon Proof Single-Ring MGP is able to withstand the **Beaufort force 12+** and the Multiple-Ring can withstand **Beaufort force 10** without any damage.

The velocity at which the MGP-i hit the ground is approximately 19.8 m/s, which is **far more than a 40-m wave height at 9m/s.**

The Beaufort Wind Scale and Velocity Conversions with destrutions for Land and Sea

Force	Description	Knots	mph	km/h	Wave Ht	Sea Description	On Land
0	Calm	<1	<1	<1	-	Sea like a mirror	Smoke rises vertically
1	Very Light	1-3	1-3	1-5	0.1m	Ripples	Smoke drifts
2	Light Breeze	4-6	4-7	6-11	0.2m	Small wavelets	Wind felt on face. Rustles leaves
3	Gentle Breeze	7-10	8-12	12-19	0.6m	Wave crests begin to break	Leaves and flags move
4	Moderate breeze	11-16	13-18	20-29	1.0m	Small waves frequent white crests	Paper blown about. Small branches move
5	Fresh Breeze	17-21	19-24	30-39	2.0m	Moderate waves. Many white crests	Large branches sway
6	Strong Breeze	22-27	25-31	40-50	3.0m	Large waves. While foam crests	Small trees sway
7	Near Gale	28-33	32-38	51-61	4.0m	Sea heaps up white foam in streak	Large trees sway. Difficult to walk
8	Gale	32-40	39-46	62-74	5.5m	Moderate high waves breaking crests foam streaks	Small trees blown down
9	Strong gale	41-47	47-54	75-87	7.0m	High waves dense foam streaks	Structural damage. Chimney pots removed
10	Storm	48-55	55-63	88-101	9.0m	Very high waves. Sea surface appears white	Trees uprooted. Much Structural damage
11	Violent Storm	56-83	64-73	101-117	11.5m	Exceptional high waves sometimes concreating small ships	Widespread damage
12	Hurricane	>64	>74	>119	14+m	Air filled with foam and spray. Sea white	Widespread damage

Tropical Cyclone Classifications (all winds are 10-minute averages)								
Beaufort scale	10-minute sustained wind (knots)	N Indian Ocean IMD	SW Indian Ocean MF	Australia BOM	SW Pacific FMS	NW Pacific JMA	NW Pacific JTWC	NE Pacific & N Atlantic NHC & CPHC
0-6	<28	Depression	Trop. Disturbance					
7	28-29 30-33	Deep Depression	Depression	Tropical Low	Tropical Depression	Tropical Depression	Tropical Depression	Tropical Depression
8-9	34-47	Cyclonic Storm	Moderate Tropical Storm	Tropical Low		Tropical Storm	Tropical Storm	Tropical Storm
10	48-55	Severe Cyclonic Storm	Severe Tropical Storm	Tropical Cyclone (2)		Severe Tropical Storm		
11	56-63							
12	64-72	Very Severe Cyclonic Storm	Tropical Cyclone	Severe Tropical Cyclone (3)	Tropical Cyclone	Typhoon	Typhoon	Hurricane (1)
	73-85							Hurricane (2)
	86-89		Intense Tropical Cyclonic Storm	Severe Tropical Cyclone (4)				Major Hurricane (3)
	90-99							
	100-106							Major Hurricane (4)
	107-114							
	115-119		Very Intense Tropical Cyclonic Storm	Severe Tropical Cyclone (5)			Super Typhoon	
	>120	Super Cyclonic Storm						Major Hurricane (5)

The terminology for tropical cyclones differs from one region to another. This is a summary of the classifications used by the official warning centres worldwide

DESIGNED FOR 100-YEAR STORM

With this endorsement, we can now offer our customers our typhoon-proof MGP-i to meet sea conditions caused by super typhoons, hurricanes and cyclones in all parts of the world, and concurrently extend our product warranty to include conditions associated with the 100-year storm design of offshore platforms.

