

## Gradial Tub Dragline Services

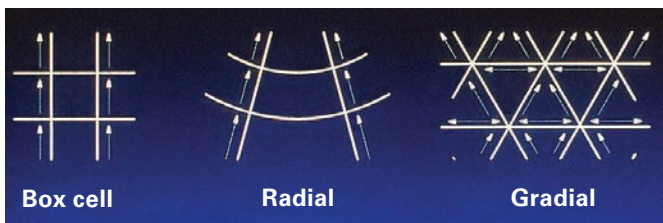
### Summary

P&H walking draglines utilize a high strength P&H Gradial Tub as a solid foundation. This tub design is superior to older box section and radial tub designs.

### Description

The P&H Gradial Tub is designed with a high strength-to-weight ratio and also a grid-radial (i.e. "Gradial") matrix of intersecting deep diaphragm steel plates to provide multiple load paths for the dynamic and ground induced forces that occur during dragline operations.

Gradial Tub diaphragm plates are oriented in a triangular grid pattern to provide multiple load distribution paths for effective distribution of multi-directional loads.



Box-type and radial tubs feature a two-diaphragm intersection design; P&H Gradial Tubs feature a four-diaphragm intersection design with uniform 60 degree angles throughout for uniform distribution of dynamic dragline loads on the tub.

### Tub design comparisons

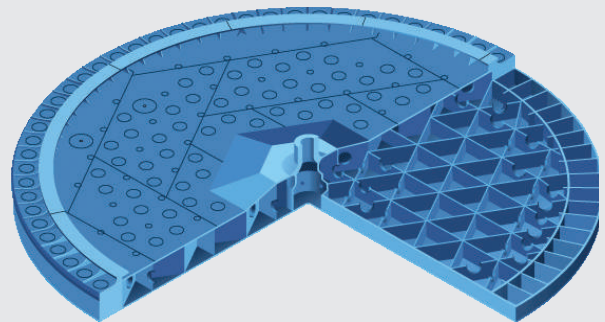
	Box grid tub	Radial tub	Gradial Tub
Overall beam stiffness			
In-line	1.00	0.72	1.09
Transverse	1.00	0.83	1.58
Total	1.00	0.80	1.45
Diaphragm stiffness	1.00	0.85	1.75
Bottom plate stiffness	1.00	0.98	1.25

### Benefits

- Efficiently distributes the dynamic, multi-direction loads that occur during dragline operations for more uniform loading, leading to higher reliability of the structure
- Deep and rugged radial-grid diaphragm structure features 60 degree angle intersections fused with patented "Verti-Shield" continuous, full-penetration weld joints, minimizing fatigue, distortion and residual stresses
- All compartments inside the rail support path are easily accessible and uniform in size to resist bottom plate deformation

### Product application

P&H 9000C-series draglines



Gradial Tub geometry



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