



**TECHNICAL NOTE 100-8**

**FAIRINGS FOR MARINE RISERS**

**CURRENT FORCES**

Marine riser deployed in high current (any flow greater than 1.0 knot is generally considered “high current”) is subjected to two potentially dangerous factors: *drag* and *vortex-induced vibration (VIV)*. Drag is the resistance of the water as it flows around the riser, while VIV is the side-to-side motion that often results from such flow. In combination, these forces may impede drilling operations or even result in serious damage. The following is a brief discussion of current forces and methods to control them.

**DRAG FORCES**

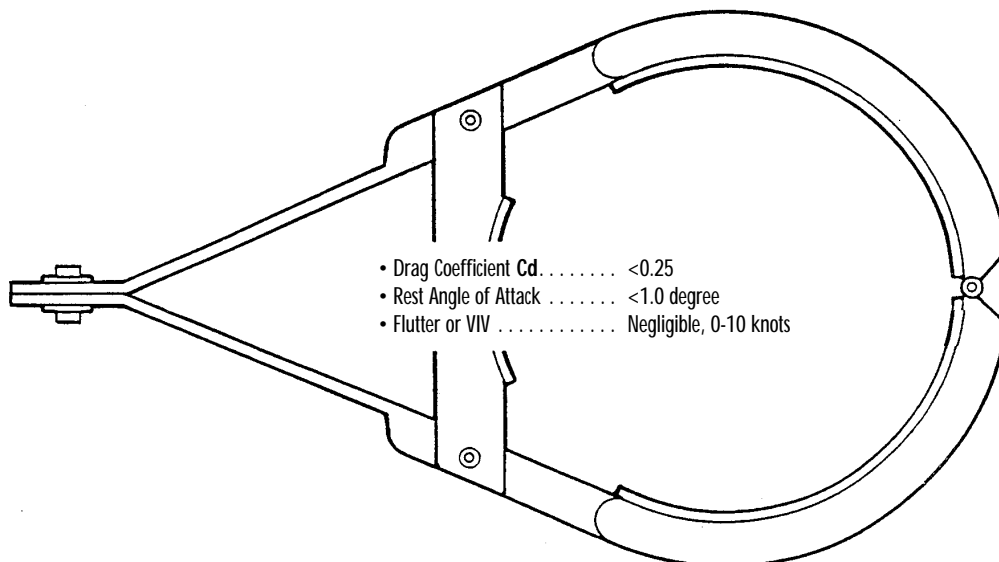
The magnitude of the drag force is proportional to (1) the speed of the current, (2) the frontal area of the riser, and (3) the *drag coefficient Cd* of the riser string. The drag coefficient is in turn influenced by the shape or geometry of the riser and the dynamics of the flow, as expressed by the Reynolds number **R**. For most offshore drilling conditions, **R** ranges from  $1 \times 10^4$  to  $1 \times 10^6$ , and **Cd** is about 1.00 for a simple cylinder. The drag coefficient will be increased if the riser is “dirty” (of complex or irregular geometry), or if it is vibrating due to VIV, so that values of **Cd** in the range of 1.50 to 2.00 are commonly found in high current situations, with even higher values possible.

**VORTEX-INDUCED VIBRATION**

When the flow of water separates around the riser, it frequently does so in an alternating series of vortices called the *von Karman vortex street*. The effect of these vortices is to exert alternating forces on either side of the riser. If the periodicity of these forces coincides with the natural frequency of the riser string, a powerful resonance can be set up which may quickly build to destructive levels. Vortex-induced vibration (VIV) may be somewhat suppressed by “dirty” riser geometry, or may actually be *increased* if the riser is suited with smooth, uniform buoyancy modules which shed vortices in a regular manner.

**STRAKES, DIMPLES, AND OTHER SPOILERS**

Since VIV is often regarded as more dangerous than simple drag, a number of techniques have been devised to spoil the formation of vortex streets. Strakes are strips or panels wrapped in a helical fashion around the riser to upset the regular shedding of vortices. Strakes are effective only in a narrow range of current speeds, and have the disadvantage of increasing both **Cd** and effective frontal area. Similar devices include “hair” and various kinds of fibrous matting attached to the riser, none of which have found much favor. Another concept is to mold *dimples* into the surface of the buoyancy modules, similar to the texture found on golf balls. The available evidence suggests that



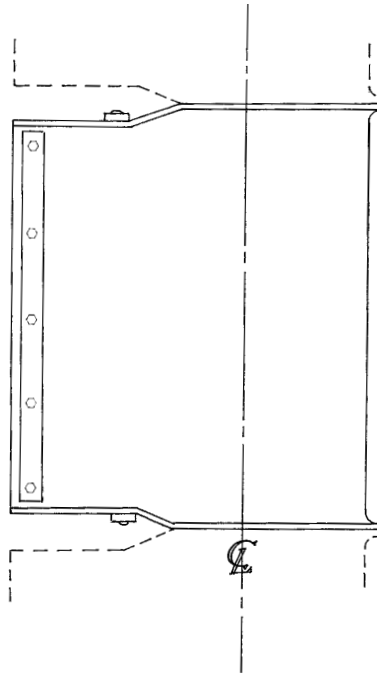
dimples are of limited effectiveness, and no large-scale testing has been done

## FAIRINGS

The most effective and most field-proven solution to both drag and VIV is to suit all or some portion (often the upper joints) of the riser with streamlined shrouds or *fairings*. The "teardrop" profile of the fairings can reduce drag to a fraction of that experienced by the bare riser and virtually eliminate VIV. If the direction of the current is constant, the fairings can be fixed; however, if the current is variable, the fairings must be free to rotate or "weathervane" around the riser. This in turn requires that the fairings be provided with low-friction bearing surfaces and designed to generate sufficient turning moment to guarantee accurate "pointing" (minimum angle of attack) into the current. Other important considerations include quick and easy assembly to speed installation on the riser in the moonpool, and rugged construction to withstand wave action during running of the riser.

## C-FLOAT FAIRINGS

Cuming Corporation is an acknowledged leader in the design and manufacture of syntactic foam riser buoyancy modules, and the most experienced maker of riser fairings in the world; our engineers have over 25 years of experience in the design of riser buoyancy systems, fairings, and accessories for the offshore oil industry. **C-FLOAT** buoyancy is being used by many major operators, including Sedco Forex, Diamond Offshore, Enserch Exploration, and Reading & Bates. We have supplied successful fairings to Shell Offshore, Mobil Oil, and British Gas. Listed below are typical performance parameters achievable with **C-FLOAT** riser fairings. Actual performance will depend upon specific design conditions. For more information, consult Technical Bulletin 163 or call 1-800-432-6464 to speak to our application engineers.



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