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02

CUMING

TECHNICAL NEWS BULLETIN 02

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C-FLOAT BUOYANCY MODULES: FUNDAMENTALS OF MAXIMIZING PERFORMANCE, EFFICIENCY, SAFETY, AND LONG SERVICE LIFE

INTRODUCTION

Cuming Corporation has been a leader in syntactic foam buoyancy for offshore oil and gas operations since the company was founded in 1980, and our experience goes back much farther. Cuming Corporation engineers made the first riser buoyancy for the original *Bluewater* semisubmersible rig in 1968. Over the years, we have shipped more than 60,000 drilling riser buoyancy modules (see Cuming Events No. 19, Spring 2009) and pioneered a long list of improvements. Technical News Bulletin 01 (September 2001) revolutionized the industry with the introduction of "Ruggedized" modules. Now Technical News Bulletin 02 offers new ways to maximize the value of your investment in high performance buoyancy.

FIGURE 1

Hydrostatic pressure vessels used to test ***C-FLOAT*** products at full rated depth

QUALITY ASSURANCE

Cuming Corporation engineers are known for experience, competence, and a "full service" approach to meeting customer requirements. This follows through in materials selection, manufacturing, quality control, and product testing. Cuming Corporation's hydrostatic pressure test facility is the largest and best-equipped in the world, capable of testing full-size modules as deep as 14,500 feet. Bend test and impact testing machines subject ***C-FLOAT*** modules to the same rough service they experience on board oil rigs, proving that Cuming Corporation products are the most rugged and dependable in the world.

RECORD-SETTING PERFORMANCE

The key to making efficient buoyancy modules is to maximize strength while keeping density low. ***C-FLOAT*** syntactic foams are under constant development and refinement to achieve the highest possible strength-to-weight ratio. A variety of materials grades are available to match performance to customer needs.

TABLE 1

Depth vs. Density of *C-FLOAT* Riser Buoyancy Modules
(Custom high-integrity and ruggedized constructions also available)

Service Depth Rating, Feet (m)	Standard *C-SDF* Construction, lbs/ft^3 (kg/m^3)	Low Density *C-LDF* Construction, lbs/ft^3 (kg/m^3)	Ultralight *C-ULF* Construction, lbs/ft^3 (kg/m^3)
2,000 (610)	24.0 (385)	23.0 (369)	22.0 (353)
4,000 (1220)	27.0 (433)	26.0 (417)	24.0 (385)
6,000 (1829)	31.0 (497)	29.0 (465)	27.0 (433)
8,000 (2439)	35.0 (561)	32.0 (513)	30.0 (481)
10,000 (3049)	38.0 (609)	36.0 (577)	33.0 (529)
12,000 (3658)	42.0 (673)	39.0 (625)	37.0 (593)

Note: All densities are nominal and approximate only. Consult with our skilled engineers to determine the most efficient construction for your application.

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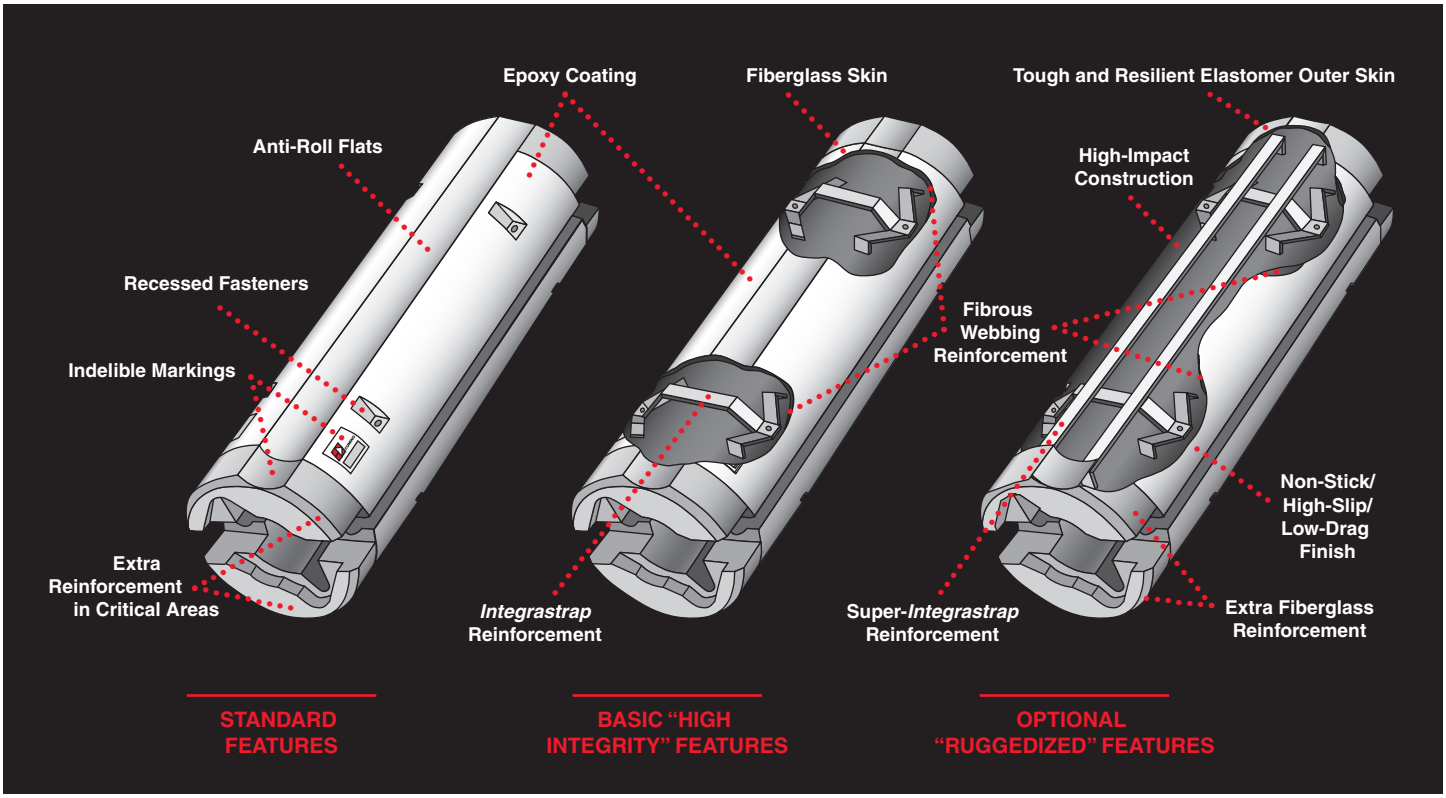
MODULE INTEGRITY AND RUGGEDNESS

Cuming Corporation's ***C-FLOAT*** riser buoyancy modules have by far the best damage-resistance record in the industry. However, recognizing that many offshore environments are especially demanding, our engineers have designed and tested a number of construction options to provide even more durability. The reinforcement options fall into two main categories, as illustrated in Figure 2: the High-Integrity ("HIT") System of tough fibrous webbing cast into the module to provide extra safety and prevent separation of parts in case of fracture; and the Ruggedized ("RGD") System of additional metal or composite reinforcements cast into the module to provide extra strength in resisting impact or bending.

In addition to these construction options, the basic chemistry of ***C-FLOAT*** syntactic foam has been modified to improve its strength and toughness, resulting in increased damage tolerance and a much lower rate of water absorption over time. The net effect is greater durability and longer useful life, even under the harshest offshore conditions. These features are protected under United States patent no. 7,121,767 B1.

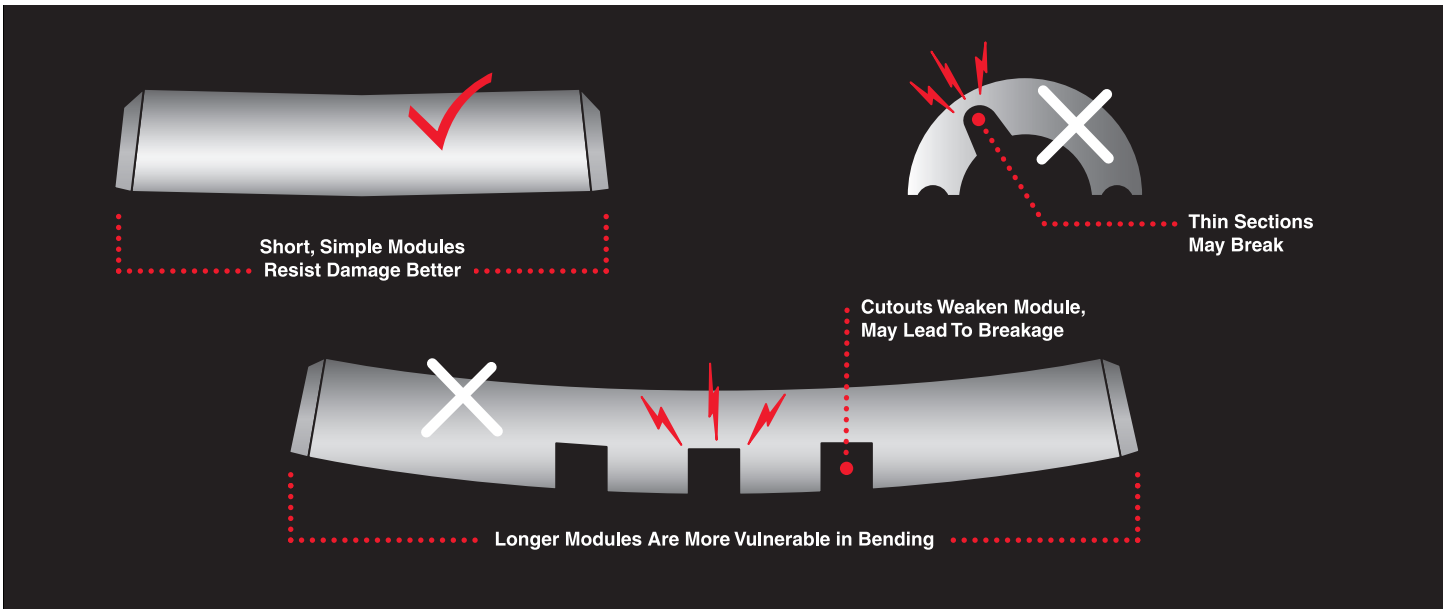
FIGURE 2



DESIGNING FOR SAFETY

Often a simple design change can improve the inherent ruggedness of buoyancy modules. As shown in Figure 2A, short modules resist bending loads better than do long modules. Clamp cutouts, thin sections, and other stress-inducing features can further weaken the module structure, and should be avoided if possible.

FIGURE 2A

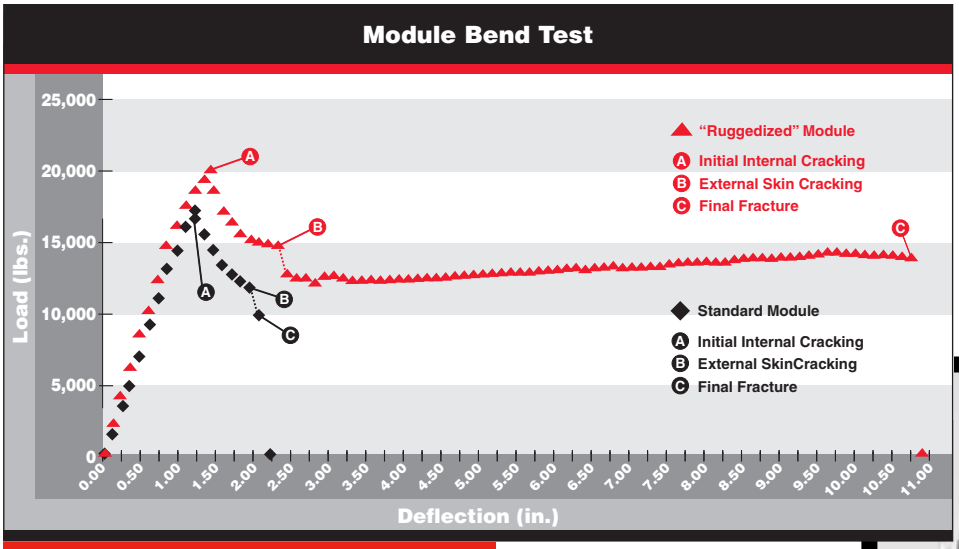


TESTING AND VERIFICATION

All of these features have been extensively tested. Below, Figure 5 shows the testing machine that measures impact and bending strength of full-size modules. Figure 4 depicts a module undergoing destructive bend testing. Figure 3 demonstrates how the internal reinforcement of the high integrity "HIT" system keeps the module in one piece despite being broken in two. Graph 1 shows the strength of the ruggedized "RGD" system.

In addition to greatly increased bending strength, test data shows that ruggedized features can more than double module toughness and increase by more than twice the amount of impact energy required to initiate surface cracking. Cuming Corporation's proven high integrity and ruggedized constructions are United States patent protected. Many options are available, and our engineers are prepared to customize them to suit customer requirements.

GRAPH 1



Bending Performance of "Ruggedized" vs. Standard Modules

FIGURE 3

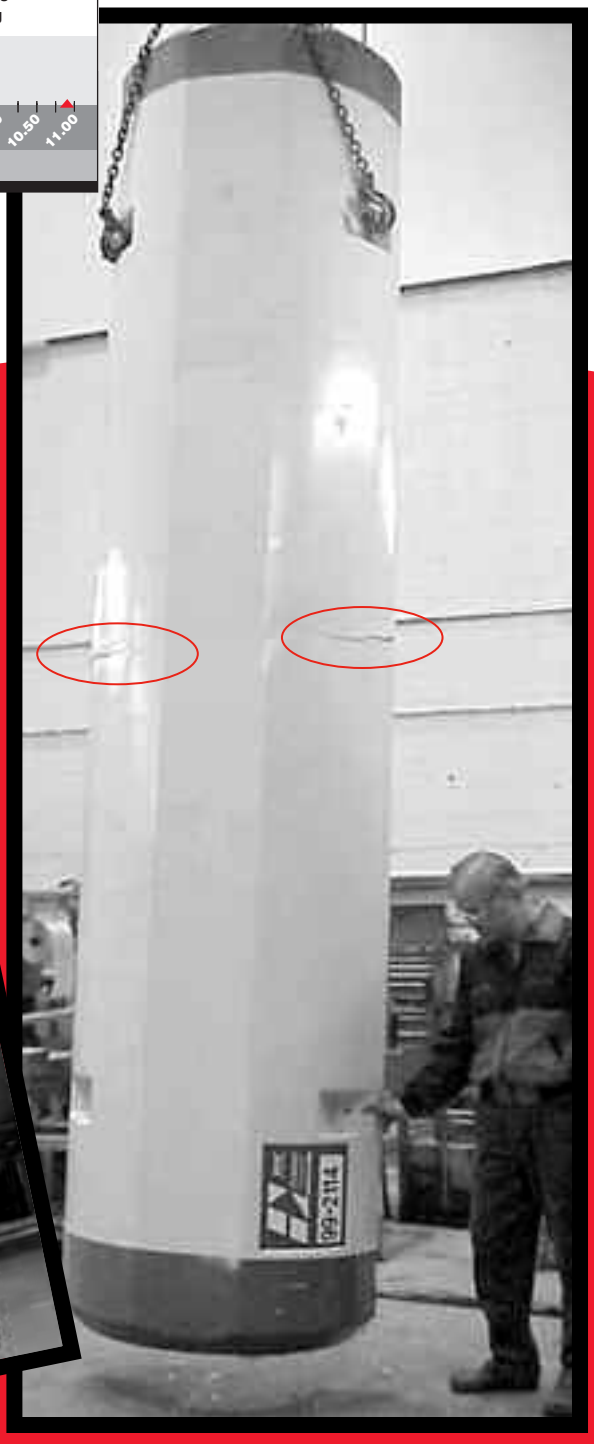
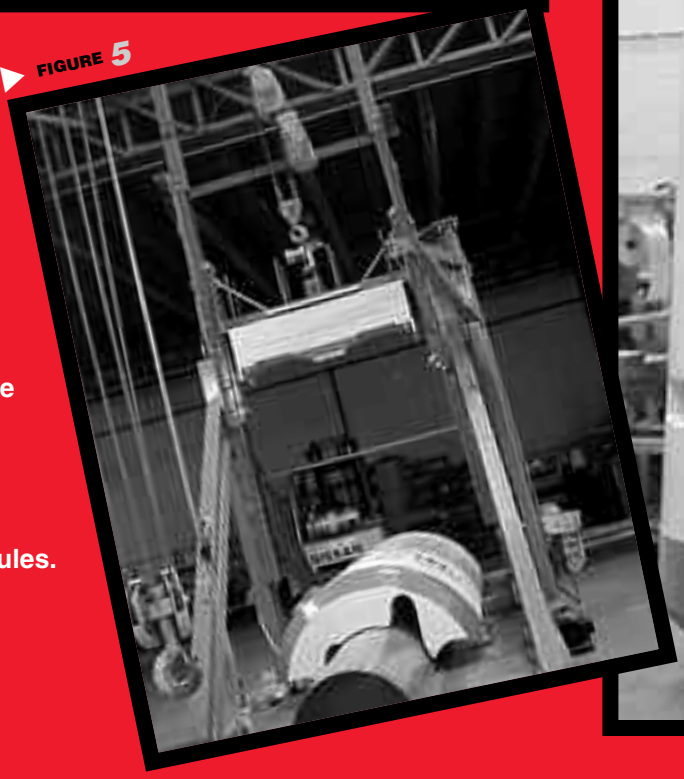


FIGURE 4

FIGURE 5

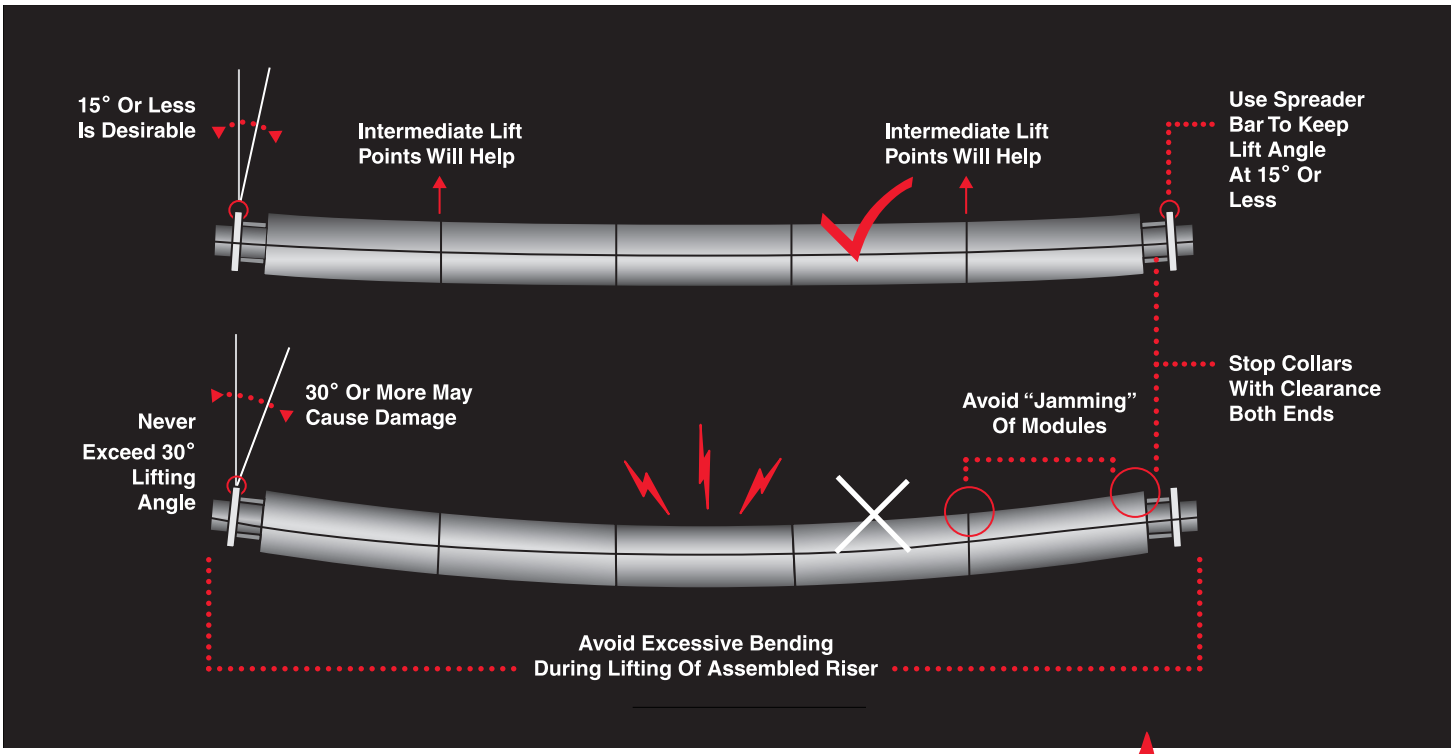


Thorough testing verifies outstanding strength and damage resistance of Ruggedized/High Integrity ***C-FLOAT*** riser buoyancy modules.

HANDLING AND INSTALLATION

Technical Note 100-9, available on our website, gives complete instructions for safe and proper handling and installation of ***C-FLOAT*** riser buoyancy modules. Stop collars are recommended for both ends of each riser joint to restrain longitudinal movement of the modules during running of the riser. Adequate clearance must be provided between modules to allow for bending and expansion and prevent "jamming" of modules when the riser is lifted. Figure 6 shows how excessive bending can occur if a spreader bar is not used to maintain a lift angle of 15° or less. If the riser bends too much, the deflection may exceed the height of the module flex lugs, resulting in damage.

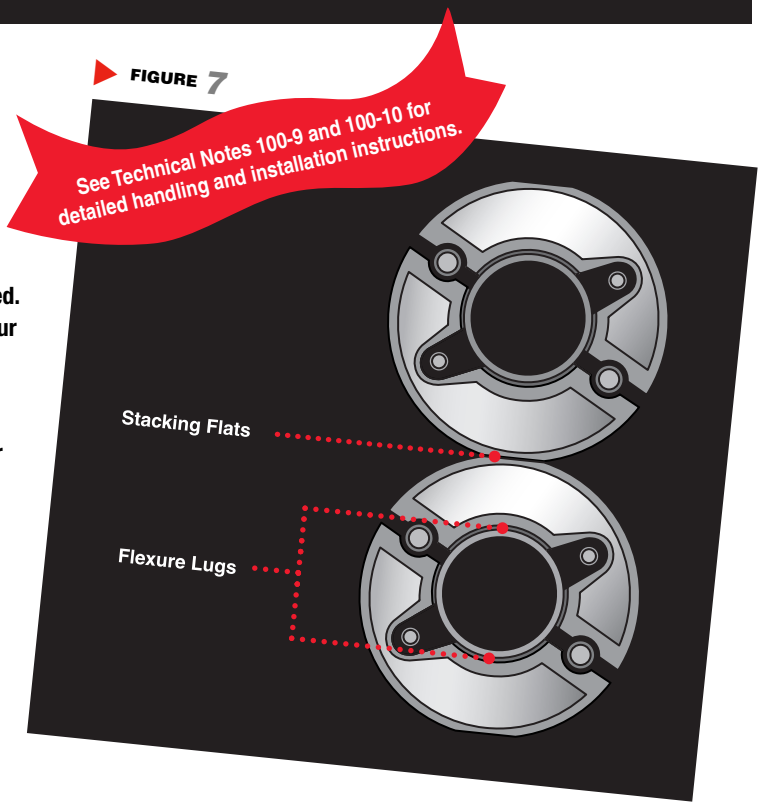
FIGURE 6



STACKING AND RACKING

Technical Note 100-10, also available on our website, gives complete instructions for stacking ***C-FLOAT*** buoyancy modules after assembly onto risers. Care must be taken to locate loads in line with the module flexure lugs to avoid bending stresses. Modules are equipped with 12.00" wide stacking flats for stability and safety, as shown in Figure 7. Direct bearing stresses at all points on the modules must be kept at or below 1,000 psi if local compressive failure is to be prevented. Contact our engineering department for advice regarding your storage options.

FIGURE 7



MAINTENANCE AND REPAIR

The only regular maintenance required is occasional checking of fastener torque and tightness. Cuming Corporation can supply module repair kits for repair and refurbishment of the most common kinds of minor or superficial damage to buoyancy modules. More substantial repairs can often be made at field locations, subject to logistics, local conditions and prior arrangements. Contact us for advice.

CUSTOMER SERVICE

For more information on the subjects mentioned herein, call Flotation Products Customer Service at +508-580-2660 or 800-432-6464 (USA toll-free) or visit our website at www.cumingcorp.com.

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