CODEND & INTERMEDIATE

Codend and Intermediate

NET Systems, Inc. designs, manufactures, and services a complete line of codends and intermediates satisfying a wide range of fish catching needs. With over 33 years of experience supplying codends to trawlers worldwide, NETS continues to be the leader in this technology. With the introduction of Ultra Cross (UC) knotless PE netting in 1992, NETS revolutionized codend design by replacing "two and three-layer" codends with "single-layer" codends. This action created better water flow through the codend and made the codends easier to handle on deck. In 1994 NETS introduced UC codend made with high molecular weight polyethylene (HMPE), then moved to using SK75 Dyneema® fiber once it became available.

Codend Design and Selection

Performance Criteria that should be considered when designing a codend are:

- Volume/capacity.
- Netting Strength.
- Netting type.
- Configuration: Diamond mesh or Square Mesh
- Floatation.
- Water and fish movement through the system.
- Trawler hauling ability and deck capacity.
- Required handling rigging and hardware.
- Fish size selectivity.
- Protection from abrasion.
- Special local fisheries regulations.
- Transfer codends and brailers.

Fish Species and Size Selectivity

In today's high technology and competitive fisheries, there is a continuous need to design codends specifically to target a particular size and/or species of fish. Netting mesh size or configuration can be applied in order to accomplish this task. Options include:

- Interchangeable top panel of various mesh sizes which may be easily changed to suit the fishing condition.
- High strength and low stretch riblines may be hung to the codend shorter than the netting length to maintain opening meshes.
- Square mesh netting configuration (bars of netting run parallel and perpendicular to gores and riblines) by using Ultra Cross knotless netting maintains consistent mesh openings regardless of loading condition. It also assures maximum circumference while towing.
- Ultra Cross knotless netting is the premier netting for this application as netting distortion is virtually impossible.

Protection From Abrasion

Various materials are available to protect the new codend from abrasion resulting from the seabed, stern ramp and fish. Typically NET Systems codends are partially enclosed in a protective netting layer being of a larger mesh size

than the primary fish holding layer which enables juvenile or non-marketable species to escape. This sacrificial layer may also be covered with an additional protective layer of stranded polyethylene material commonly known as "hula skirt" or "horse hair."

Other areas which may require protection include:

- Portions of the codend beneath chokers and straps.
- Hangings and lashings which may contact the seabed.
- Portions of the codend susceptible to repeated abrasion during handling.

Water and Fish Movement Through The Codend

Maximization of water and fish flow into the codend is a priority to maintain fish catching efficiency. There are several methods which may be applied to assure this:

- Construction with a single layer of netting.
- Use the strongest and lightest netting possible.
- Use a codend with the largest circumference possible.
- Maintain open meshes through out the intermediate and codend.
- Avoid restriction around the girth of the codend.
- Proper flotation.
- Consistent circumference between the end of trawl, intermediate, and codend.
- Minimize chafing gear resistance to water flow.
- Use light weight chokers and lifting bridles.

Floatation

As large codends tend to be of heavy construction, proper floatation is critical in terms of maintaining a clear opening for the entrance of fish. A few guidelines to achieve this would include:

- Provide sufficient floatation to achieve at least neutral buoyancy.
- Install all floats in the upper portion to prevent twisting.
- Install all floatation inside the codend to prevent damage and loss.s
- Use the largest floats possible for cost savings and simplicity.

Handling Rigging and Hardware

Many options are available for hauling and handling codends. All techniques should be sized to allow for a sufficient safe working load margin to insure safety and security while lifting. Maintaining a light weight handling system is also beneficial. You can choose from many types and styles of lifting rigging including:

- Chokers made from wire rope, synthetic rope and high strength HMPE rope.
- Four-way lifting bridles made from similar materials that do not choke or abrade the codend.

Special Local Codend Regulations:

Many of the world's fisheries operate under government regulations specifying a minimum mesh size. In most cases these laws apply to the inside opening of the mesh or a between knots (BK) measure. Frequently, as a result of extended use and wear netting may stretch or shrink resulting in a violation and possible infraction of the regulation. In regulated fisheries one should consider:

- Using a netting with minimal elongation characteristics such as Ultra Cross knotless netting.
- Use well depth-stretched netting or Ultra Cross knotless netting to avoid knot slippage or distortion.
- Order netting with a slight safety margin greater than the stated legal mesh size.
- Be knowledgeable about the regulation and continue to periodically inspect the netting during use.

Strength

When the codends capacity and size have been determined, appropriate strength must be designed into the codend to facilitate safe and secure handling. Type and size of netting, riblines, container lines and other load bearing components can be selected from specific sections of this catalog.
It is vital to also consider the trawlers stern ramp and deck configuration, weather conditions, and other special conditions that may stress the codend.

Volume and Capacity

Codend capacity is determined by the following variables:

- Length and circumference.
- Density: Specific gravity of species harvested and how tightly they pack.
- Length of time fish are in the codend and the resulting compression.

To approximate volume or capacity of a 4" CC 1000 Ply codend refer to the following table.

This table should be used only for an approximation.

Codend Capacity Chart in Tons

Circumference												
ft	m											
30	9.1	17	34	52	69	86	103	121	138	155	172	
28	8.5	15	30	45	60	75	90	105	120	135	150	
26	7.9	13	26	39	52	65	78	91	104	117	129	
24	7.3	11	22	33	44	55	66	77	88	99	110	
22	6.7	9	19	28	37	46	56	65	74	83	93	
20	6.1	8	15	23	31	38	46	54	61	69	77	
18	5.5	6	12	19	25	31	37	43	50	56	62	
16	4.9	5	10	15	20	25	29	34	39	44	49	
14	4.3	4	8	11	15	19	23	26	30	34	38	
12	3.7	3	6	8	11	14	17	19	22	25	28	
10	3.0	2	4	6	8	10	11	13	15	17	19	
		3.0	6.1	9.1	12.2	15.2	18.3	21.3	24.4	27.4	30.5	m
		10	20	30	40	50	60	70	80	90	100	ft

Codend Length

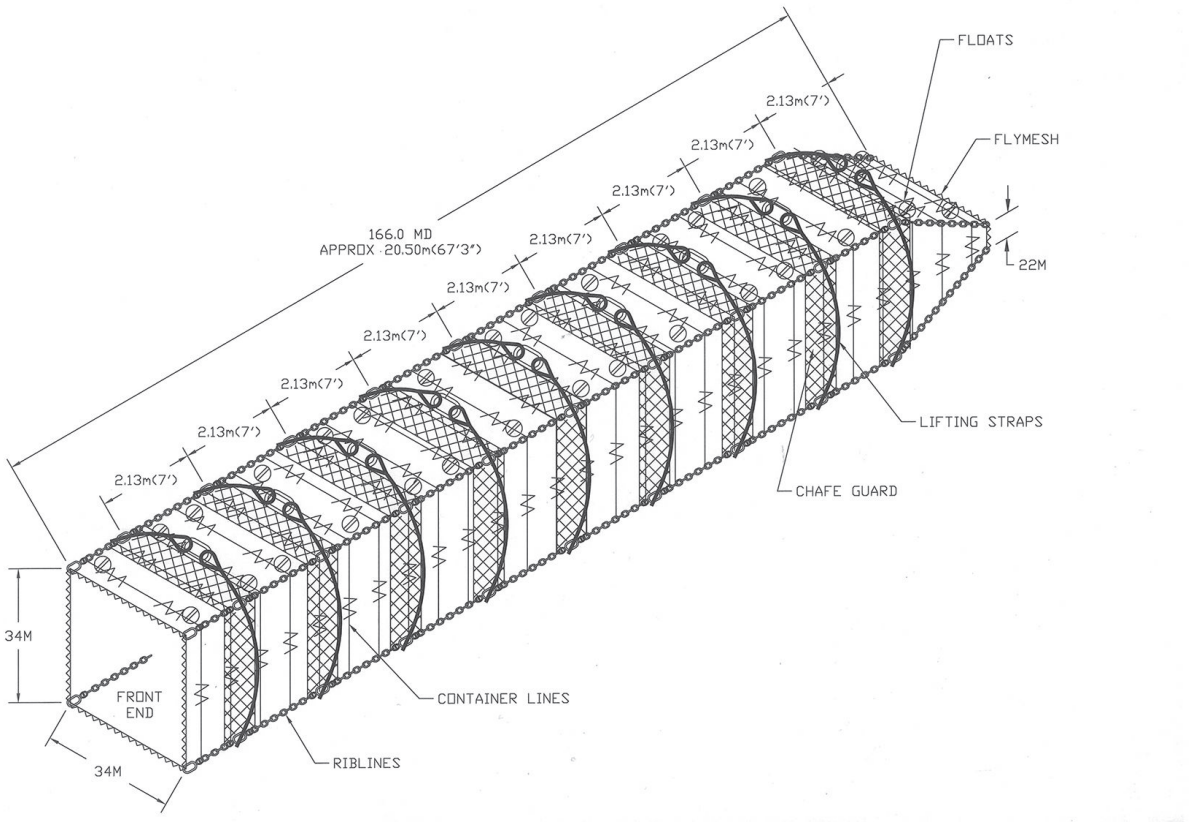
Codend Construction Details

The Codend or "money bag" is designed as an integral part of the trawl system. The codend is tailored and hung to achieve a desired shape so that fish easily pass into it and are held there until it is hauled. Materials are chosen to produce these desired results and give long lasting service. Important features include:

- Low- Stretch synthetic riblines that help support the mesh and result in better codend openings and longer material life.
- Chain riblines, an innovation of Net Systems, provide a very stable length and a positive means of attachment that does not slip even with the large, 150 ton codends.
- High strength fibers such as Dyneema® are used effectively for braided riblines on codends. Dyneema® ropes such as Amsteel and Amsteel Blue have worked excellent as riblines for large codends.
- Stretched and heat set webbing material made from high quality twines prolongs codend life.

(continued on page B.6)

Typical Codend Plan



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Codend Construction Details

(continued from page B.5)

- NET Systems manufactures and supplies Ultra Cross knotless netting (UC) using Dyneema® fiber and high tenacity polyethylene fiber (UCPE) for codends. These high quality fibers provide high strength netting per diameter and excellent abrasion resistance due to its low profile. The Ultra Cross netting has replaced multiple layers of other netting types, resulting in cleaner catches and a higher grade product.
- Codends from conventional knotted netting are available as well. Knotted netting has 40% less strength due to having knots than NET Systems Ultra Cross knotless netting.
- The bulk of a codend can be reduced significantly by using UC Silver or PE knotless netting rather than two or three layers of large diameter knotted netting. As a result, drag is reduced for the trawl system.
- Every codend is suspended on a large jig during construction to ensure that all the components are accurately installed and the codend will open properly when fishing.
- Codend rigging is given special attention so that unnecessary wear on the web, expansion lines, and riblines are avoided.

Typical Intermediate Plan