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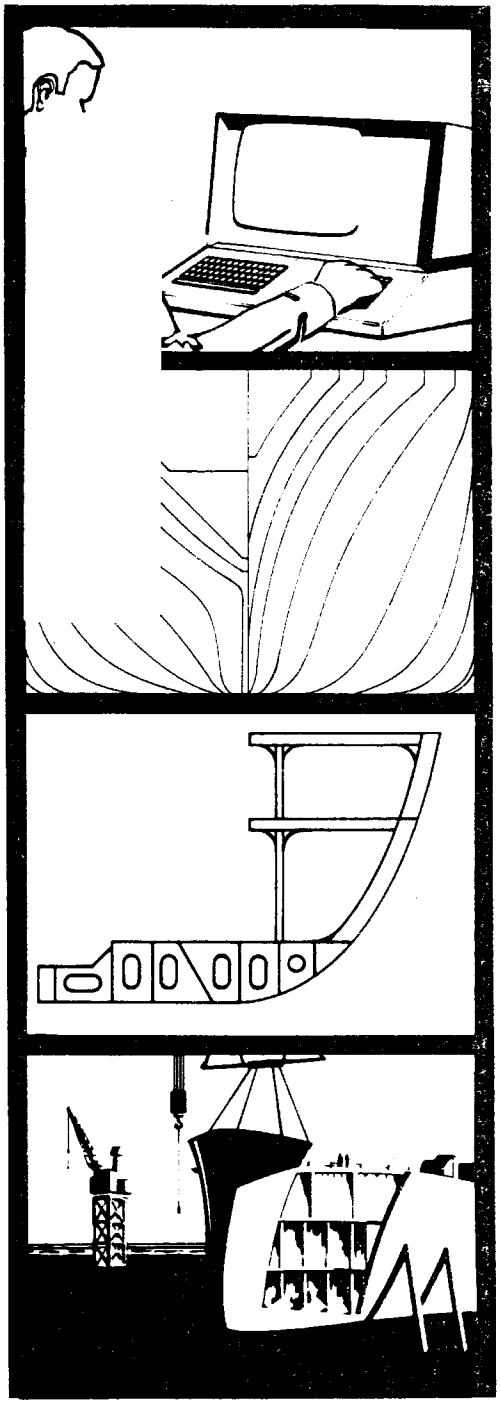

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AND
E NGINEERING
FOR
A UTOMATION
AND
P RODUCTIVITY
IN
S HIPBUILDING

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THE SFI CODING AND CLASSIFICATION SYSTEM FOR SHIP INFORMATION

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This paper is about a classification system, or group, account, charge or whatever you call it in your organization. What is different about this system is that it was developed by a group of shipbuilders and shipping companies under the leadership of their national, non-profit research association. When completed and field tested, it was adopted by all members of the maritime community, both public and private. This country was Norway.

Today no one in Norway uses any other system for ship breakdown. In addition, the system is gathering a worldwide following.

The system is called the SFI Group System.

The SFI Group System is a classification system for ship technical and cost information.

During the life cycle of a ship - from conceptual design through detailed design and construction to operation and maintenance - much information must be exchanged

within an organization and between organizations. During the sixties, Norwegian shipbuilding was booming. In addition, electronic data processing had come into its own. Naval architects, shipbuilders, ship owners, regulatory bodies and marine suppliers were looking for a common ground for specification indexing, drawing, numbering and cost accounting.

The Norwegian shipbuilders took the lead, primarily because they were subcontracting to each other, and asked their national research association to sponsor an effort to develop a common ship breakdown system. The SFI Group System was, thus, sponsored by the Ship Research Institute of Norway.

The system was developed primarily by shipyards. It was correctly assumed to be difficult enough to create unanimity among the yards without involving other parties. Several yards provided representatives to help in the development of the SFI Group System lending expertise in estimating, engineering, planning, purchasing, production and EDP. The shipyard representatives were from a broad spectrum of the industry with experience in building ships of all types and sizes. Among the major contributors was the Aker Group - with which my firm is proud to be associated - and which brought the world numerically controlled burning and computer-aided lofting.

During the development phase, ship owners provided input to the working committee and were, in fact, the first to test the system as a maintenance code on board different types of ships - from cargo liners to North Sea trawlers. The experience gained from ship owners was very valuable.

The SFI Group System development was completed and tested in a pilot yard in 1972. The test not only checked the comprehensiveness of the system but provided an

opportunity to analyze routines associated with the use of the system. As might be expected, the routines and procedures in any particular shipyard might not accommodate a given system and it was important to check the system's flexibility.

At the end of the test period, minor changes were made and the SFI Group System was adopted by the Norwegian maritime community. Each user has a contact who stays in touch with the Ship Research Institute concerning changes in ship technology that might affect the system. The Norwegian Ship Research Institute, or NSFI, maintains and revises the system as necessary to accommodate new technology.

The basic criteria for designing the SFI Group System were:

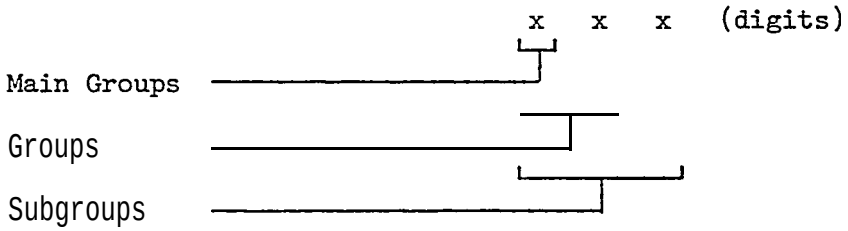
1. that it must be applicable to all users
2. that it must be applicable to all types of ships
3. that it must be simple and easy to understand
4. that it must be capable of future expansion.

As shipbuilders had first crack at designing the system, the immediate argument that had to be resolved was whether the system was to be function oriented or Production oriented. This argument, although interesting, is moot. Production methods change within a shipyard and certainly are different from shipyard to shipyard. Engineering and estimating simply cannot accommodate a production-oriented ship breakdown system whereas production can accommodate a function-oriented ship breakdown.

The SFI Group System is, thus, a function-oriented system. Classification societies, ship owners and naval architects would be lost with a production-oriented system.

In fact, it is rigorously functionally oriented. Components as well as piping are found under the same account number for a given ship's system. Electric motors for pumps are not segregated but are grouped with the driven component. The SFI Group System is designed to conform to a logical ship's specification, to accurately collect direct costs during the design, planning and production phases, and to organize the return costs in a way that they can easily be used as a basis for estimating the cost of similar ships in the future.

The SFI Group System is built up as a three-digit decimal classification system with ten main groups at the highest level. At this time only eight main groups are in use. Each of the main groups (one digit numbers) consist of ten groups (two digit numbers) and each group is further subdivided into ten subgroups (three digit numbers). Hence, the structure of the Group System numbers is as follows:



The main groups are used as follows:

0:

Reserved for a special purpose.

1: Ship General

Includes costs which cannot be charged to any specific function on board, such as launching, trial trips, guarantee work.

2: Hull

Includes hull and superstructure as well as cleaning and painting of the ship.

3: Equipment for Cargo

Includes equipment and systems concerning the ship's cargo, such as hatches, cargo winches, cargo pumps and piping.

4: Ship Equipment

Comprises equipment and systems which normally are peculiar to ships, such as navigation equipment, anchoring equipment. It also includes fishing equipment and weapon systems along with other working equipment for special types of ships.

5: Equipment for Crew and Passengers

Includes equipment and systems which serve crew and passengers, such as furniture, elevators, hotel systems.

6: Machinery Main Components

Comprises the primary components in the engine room, such as main engine, boilers, auxiliary engines.

7: Systems for Machinery Main Components

Includes main propulsion systems, such as fuel and lube oil systems, starting air system, exhaust systems.

8: Ship Systems

Comprises auxiliary systems, such as bilge and ballast systems, fire fighting and wash down systems, electrical distribution systems.

9:

Reserved for a special purpose.

As an example, the freezing system for dry cargo would be derived from:

Main Group 3 : Equipment for Cargo
Group 36 : Freezing, Refrigerating and Heating Systems for Cargo
Subgroup 362: Freezing and Refrigerating Systems for Dry Cargo

Illustrations of how this is presented in the SFI Group System book are:

the main group **3** matrix (see Figure 1)
the subgroup 362 description (see Figure 2)

Note that the description of each subgroup shows what that subgroup does not include as well as what it does include.

The SFI Group System book contains several parts. There is a six-page guide to use of the system follcwed by a matrix showing the 100 possible two-digit groups. This is followed by a chapter for each main group. These chapters begin with a

MAIN GROUP 3 — EQUIPMENT FOR CARGO

SUBGROUPS	35 LOADING AND DISCHARGING SYSTEMS FOR LIQUID CARGO.	36 FREEZING, REFRIGERATING AND HEATING SYSTEMS FOR CARGO.	37 GAS/VENTILATION SYSTEMS FOR CARGO HOLDS/TANKS.	38 AUXILIARY SYSTEMS AND EQUIPMENT FOR CARGO.	39
	350	360	370	380	390
	351 Loading and discharging pumps.	361 Insulation and sheathing of cargo holds and tanks.	371 Ventilation systems for refrigerated cargo holds.	381 Sounding. control and operating equipment for cargo systems.	391
	352 Loading and discharging systems on deck	362 Freezing and refrigerating systems for dry cargo.	372 closed Cycle mechanical ventilation systems for cargo holds.	382 Tank cleaning systems and equipment.	392
	Loading and discharging systems in pump rooms.	363 Direct cooling systems for liquid cargo.	373 Open ventilation systems for cargo holds.	383 Lifting gear for cargo hoses.	393
	Loading and discharging systems in cargo tanks.	364 Cascade cooling systems for liquid cargo.	374 Ventilation/gas freeing systems for tanks. Wind sails with equipment.	384 Separate cooling water systems for cargo equipment.	394
	355 Loading and discharging systems for LPG, LNG, etc. in gaseous phase.	365 Indirect cooling/ heating systems for cargo (cargo oil heating, etc.).	Blow-off 375 systems from safety valves (from pressure/ vecuum valves and similar).	385 insulation drying system for cargo holds and tanks.	395
	356 Separate stripping system.	366	376 Inert gas systems with conditioning plant.	Equipment 386 for addition/portioning of preservatives, smelling substances. inhibitors. spirits. etc.	396
	357	367	377 Fuel gas system with conditioning plant.	387 Special structures for loading/discharging over sternistem.	397
	358	368	378	388	398
	359	369	379	389	399

SFI GROUP SYSTEM — JAN. 73

PARTIAL MAIN GROUP 3 MATRIX

Figure 1

36 Freezing, refrigerating and heating systems for cargo

362 FREEZING AND REFRIGERATING SYSTEMS FOR DRY CARGO

Freezing and refrigerating systems tar dry cargo (e.g. fruit, vegetables, meat, etc.) and also for dry cargo and provisions combined, including such as:

Refrigeration machinery with compressors including drive units, condensers, evaporators, cooling batteries, oil separators, driers, etc.
Circulation system (for brine, ammonia, Freon or similar) with circulation pumps, valves, insulation, pipes, etc.
Fans for circulation by/through cooling batteries.
Drip water trays with drain pipes.

Also included here is the refrigeration machinery (which follows the ship) for containers, with connection hoses and associated machinery as stated above, together with refrigeration machinery for plate freezers, for freezing tunnel, for ice production and far RSW plant (Note! see also Ref.) with associated machinery as stated above.

Ref: Containers with separate refrigeration machinery (which follows the container) 317
Insulation of cargo holds and tanks 361
Ventilation plant with ozone generator, etc. for refrigerated cargo holds 371
Arrangement for remote measurement of temperature, CO_2, humidity, etc. 381
Supply lines from separate cooling water system for cargo equipment, for thawing (de-icing) of refrigeration machinery 384
RSW plant (seawater part) 384
Plate freezers, freezing tunnel (in factory plant for fish, etc.) 468
Refrigeration machinery for provisions 554
Supply lines from the ship's main cooling water system for thawing (de-icing) of refrigeration machinery, se resp. s.gp in . . . . gp 72
Drain pipes from sink, including those, in cargo holds 804

363 DIRECT COOLING SYSTEMS FOR LIQUID CARGO

Direct cooling systems (one or more stages) for recondensation of gas cargo, where the boil-off is extracted from the tanks, compressed and condensed directly by cooling water. The system includes such as:

Suction pipes from tanks or loading/discharging pipes with valves, etc.
Fluid separators with return pump, piping, etc.
Compressors with drive units (low and high pressure compressors for multi-stage plant), filters, etc.
Medium pressure vessels with equipment (for multi-stage plant).
Fluid collectors.
Cargo condensers.
Return pipes for the condensed cargo to tanks or to the Ioading/discharging system.

Also included here is the arrangement for lubricating the compressors, with equipment for oil regeneration.

The cooling plant, or parts of it, can have subsidiary functions (but comes under this s.gp) and function as:

Pumps for cargo heating.
Producer of gas for transfer of cargo for discharging by means of pressure.

Continues

GROUP AND SUBGROUP DESCRIPTION

matrix showing the 100 possible three-digit subgroups within each main group followed by a detailed description of each group and subgroup. Finally, there is an alphabetical index (Figure 3) with more than 4,000 entries that should lead the searcher to the proper subgroup number. For our "freezing and refrigerating system for "dry cargo" example, the most obvious entry appears on page 32 of the index although it appears elsewhere as well.

The books are loose leaf to facilitate changes and are made of all water resistant materials. A condensed, pocket-sized version containing only the main group matrices and index is also available.

For those requiring even further breakdown than the three-digit system provides, NSFI has developed two sets of supplementary codes. Designed primarily for material, the first set is for direct purchased material and must be used in conjunction with the appropriate subgroup (Figure 4). Using our "freezing and refrigerating systems for dry cargo" example, the number 362 003 would always identify the freezing system compressor or compressors. The second, or section 2 detail code, is a listing of stock materials and does not necessarily need to be identified with the appropriate subgroup (Figure 5). Each of the detail codes contains three digits and is published in a supplementary booklet.

With its flexibility and functional orientation, the SFI Group System can be used for any shipyard classification problem. It can, and should, be used consistently in all of the following areas:

1. indexing of specifications
2. drawing identification
3. purchase requisition and order numbering

INDEX

Figure 3

Gr. 36 FRYSE-, KJOLE- OG VARMESYSTEM FOR LAST

U.gr. 361 ISOLASJON OG KLEDNING AV LASTEROM/-TANKER 361

361060		
361061		
361082		
361083		
361084		
361085		
361086		
361087		
361088		
361089		

U.gr. 362 FRYSE-/KJ0LESYSTEM FOR T0RRLAST 362

362 001	KJoleaggregat, kuldemedium..	Cooling agg. cooling medium
362 003	Kjolekompressor m/drivenhet	Cooling compressor
362 005	Kondenser	Condenser
362 007	Vaeskesamler	Liquid receiver
362 009	Fordamper	Evaporator
362 011	Vaeskeutskiller	Liquid separator
362 013	Torkefilter	Drying filter
362 015	Sugefilter	Suction filter
362 017	Oljeutskiller	Oilseparator
362 019	Sirk.pumpe, kuldemedium	Circulatlonpump. cooling med.
362 021	Fyllepumpe, kuldemedium	Supplypump. cooling med.
362 023	Kuldemediumtank	Tank for cooling medium
262025	Lokalt kontrollpanel	Local controlpanel
362 030	Lakekjoler	Brinecooler
362 032	Lakeforvarmer	Brinepreheater
362 034	Blandetank	Mixingtank
362 036	Sirk. pumpe. lake	Circulationpump, brine
362 038	Fyllepumpe, lake	Supplypump, brine
362 040	Laketank	Brinetank
362042	Kjolebatterier	Cooling batteries
362044	Sirkulasjonsvifte	Circulation fan
362070	Smoreoljesystem, compressor	Lub.oil system, compressor
362071	Smoreoljepumpe	Lub.oil pump
352073	Smoreoljefilter	Lub.oil filter
362075	Smoreoljeseparator	Lub.oil separator
362077	Smoreoljekjoler	Lub.oil cooler
362079	Smoreoljetank	Lub.oil tank
362080		
362081		
362082		
362083		
362084		
362 085		
362086		
362097		
362088		
362089		

Kjopte timer, leide timer, kjøpt ass., patentutg. etc. se Brukerorient.

DETAIL CODE, SECTION 1

Figure 4

CL. 21 INSULATION AND PACKING MATERIALS.

S.cl. 210 General.
211 Insulation and fire proof materials (excl. pipe insulating materials.
212 Pipe insulation materials.
213
214 Plate and box packings, cord and strip packings incl., packing material.
215 Flange packing rings, manhole and inspection hatch packing-rings.
216 Moulded packings, packings for special applications.
217 Sealing and O-rings.
218 Lip packings, U-packings, CUP and dome Packings. incl., sealing rings for rotating axles.
219 Diverse.

CL. 22 PIPES AND HOSES INCL, PARTS FOR PLATE AND CAST IRON PIPES.

S.cl. 220 General.
221 Steel pipes.
222 Non ferreous metal pipes.
223 plastic pipes and plastic hoses.
224 Other hoses and flexible pipes.
225 Plate pipes and associated parts.
226 Cast iron pipes and associated parts.
227 Discharge pipes and associated parts (sail pipes).
228
229 Diverse.

CL. 23 COMPONENTS FOR PLASTIC PIPES AND HOSES.

s cl. 230 Generel.
231 Polyethylene components.
232 Styrene components (synthetic rubber).
233 Nylon based components.
234 P.V.C. components.
235
236
237 Pipe components for plastic pipes with coupling, decoup ling arrangements.
238 Hose clamps and junctions (not fire fittings/equipment).
239

CL 24 PIPE COMPONENTS FOR STEEL AND METAL PIPES. (Excl. plate and cast iron pipes).

s cl. 240 General
241 Components for steel threaded pipes, Black steel.
242 Components for steel threaded pipes. Steam.
243 Components for steel threaded pipes Gelvanized.
244
245 Components for brass threaded pipes.
246 Couplings etc., components far smooth (seamless) pipes.
247 Bends, Hanges. etc., components for smooth (seamless) pipes
248 Unions. bulkhead flanges, deck penetrations etc.
249 Diverse

DETAIL CODE, SECT ION 2

Figure 5

4. work package identification
5. labor and material cost collection
6. test agenda identification
7. technical manual identification
8. recommended spare parts list identification
9. estimating
10. guarantee work identification
11. general filing index.

After several years of use, the information retrieval capabilities of the shipyard are greatly enhanced.

Now, carry the application of the SFI Group System one step further as the Norwegians have done. Have all shipyards, naval architects, marine suppliers, the ABS, MarAd, the Navy and ship owners use the same system. Communications become easy. Specifications for new construction, repair, material and subcontracting are more consistent in format. Design and testing criteria for each system can readily located. Cost and progress reporting do not need to be translated from one account system to another. Duplicate sets of financial books are eliminated. It is even possible that shipyard qualification to DOD Instruction 7000.2 can become understandable with a common frame of reference.

Is standardization possible? Norway has a far larger merchant fleet and an equivalent number of shipyards as the U.S. The answer, then, probably lies in the willingness of MarAd and the Navy to jointly agree to such a move.

With or without standardization, if your shipyard doesn't have a functionally-oriented classification system similar to the SFI Group System, it should have. And if your system isn't as good as the SFI Group System, it should be. The advantages of a well-designed classification system are too obvious.