Abruzzo Costiero S.r.l.

Deposito di Pescara

Progetto di realizzazione del nuovo sealine e del campo boe per lo scarico di gasolio e benzina da navi petroliere al largo del Porto di Pescara

Relazione tecnica - Chiarimenti volontari del Proponente nell'ambito della Procedura Istruttoria VIA

ALLEGATO 10 – Estratto "OCIMF – Guidelines for the handling, storage, inspection and testing of hoses in the field"

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Guidelines for the Handling, Storage, Inspection and Testing of Hoses in the Field

(Second Edition — 1995)

The OCIMF mission is to be the foremost authority on the safe and environmentally responsible operation of oil tankers and terminals, promoting continuous improvement in standards of design and operation.

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1. INTRODUCTION

At offshore mooring installations, the hose strings are a critical link between the terminal and tanker. They are constantly subjected to the dynamic forces of the sea which can result in severe loads and stresses within the hose. To provide greater reliability and longer life, it is imperative that the hose be handled and stored correctly and be inspected and tested in a consistent manner at appropriate intervals.

The purpose of these guidelines is to minimize hose damage from handling and storing, so as not to adversely affect operations by hose failure. Compliance with proper inspection and testing procedures will also increase the probability of detecting potential failure areas in a timely manner.

Thus, these recommendations have been prepared to provide the user with a guide to proper handling and storage and a means of determining the condition of hoses in service.

2. HOSE HANDLING

Although oil hoses are robustly constructed for a marine environment, they can be damaged from improper handling whether on land or sea. In general, while handling hoses, adequate support is the key to the prevention of over-bending (kinking), which can lead to premature hose retirement.

Particular care should be taken when launching a hose string from a beach.

2.1 Lifting

The recommended method of lifting a single large bore hose is to use a spreader bar. One or more sets of spreader bars and lifting straps of the correct size for new installations, should be delivered with the hose. The spreader bar should provide at least a three point lift on hoses up to 10.7 metres long, using a strap over the nipple area at each end and additional strapping, as appropriate, equally spaced between the end straps.

The lifting straps should preferably be flat nylon or equivalent reinforced cloth bands, and at least 150 mm wide to prevent any chafing of the hose cover. It is always most important to use such straps when handling integrally floating hose. In this case, the straps not only eliminate chafing but also reduce point loading and hence deformation of the flotation medium.

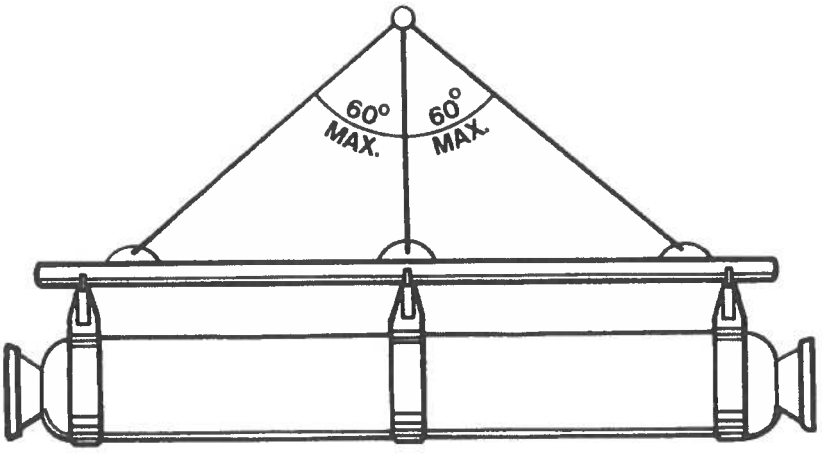

FIGURE 1 - SHOWING A TYPICAL SPREADER BAR LIFTING ARRANGEMENT.

If nylon or equivalent straps are not available, the best substitute is a sling of large circumference nylon or polypropylene rope. Wire should not be used.

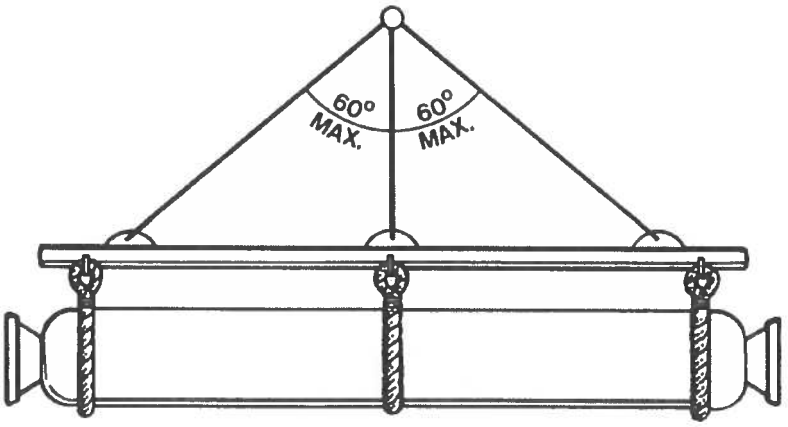

FIGURE 2 - SHOWING SUBSTITUTE ROPE SLINGS.

A hose should never be lifted by a single sling at the midpoint, or by two slings positioned one at each end. When moving a hose, it must be lifted properly and set down with care on adequate supports.

A hose should never be dragged across the ground.

2.2 Towing

Floating hoses may be towed full of water or air. It is most important to provide an integral floating hose string with support at any point of the hose that does not have integral flotation. This will often be the case with partial floating hose such as the first hose off the buoy and the tanker rail hose at an SPM.

In order to avoid damage to the hose flange, it is recommended to tow using a blind flange with towing eye. This towing method is preferred so as to protect the face of the flange and prevent foreign objects passing through the hose and damaging the tube.

Hoses should not be towed at a speed of more than 5 knots.

Submarine hoses should be towed full of air with blind flanges fitted. Bleeder valves on the blind flanges can be used to assist in providing controlled sinking on location.

3. HOSE STORAGE

Hose life in storage may be affected by temperature, humidity, ozone, sunlight, oils, solvents, corrosive liquids and vapours, insects and rodents. Hoses should be stored on steel framed pallets in accordance with the OCIMF publication entitled *"Guide to Purchasing, Manufacturing and Testing of Loading and Discharge Hoses for Offshore Moorings"*. These pallets enable hoses to be stored about three high which, in addition to reducing the area required for storage, eliminates any damage or distortion which might result if stored directly on the ground. Pallets facilitate examination and make markings easily accessible for checking. They also help to protect against insect and rodent attacks as the hoses are off the ground.

Hoses should be stored in a cool, dark, dry area or building having freely circulating air. Where closed storage is not possible, hoses should be covered to protect them from sunlight. For locations where extreme temperatures apply, additional measures may be necessary such as storing the hoses in a climatically controlled warehouse. This is especially important at extremely cold locations.

The ends of the hoses should be covered with wooden blanks with 15 mm diameter holes to allow for air circulation and to prevent internal attack by rodents.

Hose lengths should not be stored adjacent to operating equipment which could generate ozone or heat.

Hose lengths should always be laid out straight, with wide supports on level ground. Such supports should also allow for the easy insertion of suitable hose straps under and around the hose for lifting or transporting.

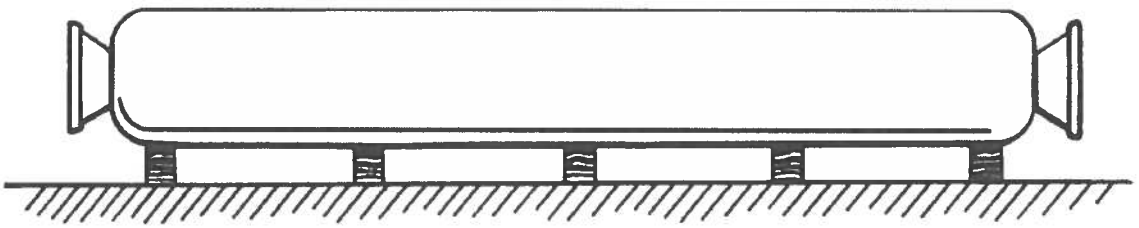

FIGURE 3 - SHOWING A HOSE LAID OUT ON TYPICAL SUPPORTS.

Hose lengths should be marked with serial number, month and year of manufacture or date code number (refer to the OCIMF publication entitled "*Guide to Purchasing, Manufacturing and Testing of Loading and Discharge Hoses for Offshore Moorings*"). These details should be carefully recorded to ensure that the oldest hose is issued first and that a rotational system is employed.

After use, and before returning a hose to storage, it should be drained completely and flushed out fully with water to remove any toxic or combustible vapours.

4. INSPECTION AND TESTING

New and used hoses which have been in storage should be pressure tested at the pressure rating of the hose before being brought into service.

For hoses taken from service, the condition should be determined by internal and external inspections together with hydrostatic pressure, electrical continuity and vacuum tests.

Tests and inspections should be conducted regularly as described in this chapter. Analysis of the test and inspection results should take into account the types of products handled through the hose, age of the hose, handling equipment used, severity of service conditions and frequency of testing and inspection. A decision, dependent on the outcome of the testing and inspection regime, can then be made whether to retire a hose or keep it in service.

It should be normal practice to inspect the tanker rail hose when it is connected to the tanker manifold, (refer to the OCIMF publication entitled "*Single Point Mooring Maintenance and Operations Guide*").

4.1 *Periodic Inspection of Underwater Hose Lines*

Routine visual inspection of the hose in service should be carried out frequently. For underwater hose, this can only be carried out properly by a diving team. The hose should be examined on the outer surface, end couplings and joints for damage and for any traces of oil seepage.

Double carcass submarine hoses have various methods of alerting the operator of primary carcass failure. The methods used must be reliable, frequently monitored and manufacturers recommendations for inspections should be strictly adhered to.

Divers should look for kinked or damaged sections (which could be caused by contact with anchor chains, marker buoy chains and crossed lines), oil seepage from the hose flange areas, heavy marine growth and scuffing on the sea bed due to incorrect setting or adjustment of bead floats or buoyancy tanks. The configuration of the sub-sea hoses and depth measurements at various points should be taken regularly so that comparisons can be made with previous inspections. If the configuration has changed it should be readjusted, as failure to do so could eventually result in kinking of, or damage to, the hose system.

Where hose lines are lowered and raised from the sea bed, as in Multi Buoy Mooring (MBM) systems, care should be taken in each operation as chains and lifting plates may cause damage. If care is taken when lowering the hose lines, i.e. by straightening the lines during the lowering operation, damage can normally be avoided. In MBM systems, pressurizing the hose strings before lifting and lowering can reduce kinking and entanglement problems on the sea bed.

Under no circumstances should hoses be allowed to free-fall to the sea bed.

4.2 *Periodic Inspection of Floating Hose Lines*

Floating hose lines can best be examined by a service craft in conjunction with a diving team. This routine inspection can be made on the outer surface of the hose only. Particular attention should be paid to the first hose off the buoy and the tanker rail hose.

Visual inspection should be made of each floating hose string prior to connection to the tanker manifold to ascertain if damage has occurred by contact with other vessels, crossed lines, kinking, oil seepage, etc. Damaged sections, should be replaced before any service operation is undertaken if the damage is considered to be critical to the service.

Periodic rotation of a floating hose string around its longitudinal axis is recommended to minimize the harmful effects of sunlight.

Floating double carcass hoses have different methods of alerting the operator of primary carcass failure. Each manufacturer has developed its own method of detection and these manufacturers recommendations should therefore be referred to when inspecting the hose.

4.3 *Testing of Hoses In-Situ*

Pressure testing in-situ of the hose strings should be performed approximately every six months depending upon environmental conditions at the buoy site. Routine testing after a very severe period of bad weather should also be considered. This test should consist of raising the internal pressure in the hose to its rated pressure, or operating pressure plus 50%, whichever is lower, and then holding it for a period of three hours. Visual inspection of all the hose should only commence when the pressure has stabilized.

The double carcass hose tests mentioned in section 4.1 and 4.2 may have to be carried out with the hose under pressure.

4.4 Inspection of Hoses on Shore

4.4.1 *Cover*

The cover on the hose serves to protect the reinforcement and the flotation material of the hose from damage. The cover should be cleaned and carefully examined to detect areas where reinforcement or flotation damage, such as cuts, gouges, tears and abraded spots may have occurred. If reinforcement or flotation material is exposed, the extent of damage should be determined by visual inspection at rest and during the pressure test. If the damage is minor, it should be repaired and the hose returned to service. Hose repair kits and instructions are available from hose manufacturers and should be provided with all new installations. If the damage is extensive, it is recommended that the hose be retired from service.

The cover may show surface cracking or crazing due to prolonged exposure to sunlight or ozone. Such deterioration, which does not expose reinforcing or flotation material, is not normally cause for retirement.

4.4.2 *Carcass*

The hose should be examined for crushed or kinked areas and broken reinforcement as evidenced by any permanent distortion, longitudinal ridges or bulges. Hoses showing such defects should be removed from service for further examination. Bulged areas should be marked and examined again during the pressure test. If these areas enlarge, become hard or exhibit other detrimental changes indicating a leaking tube or ruptured reinforcement, the hose should be retired from service.

The secondary carcass of a double carcass hose should be examined as above. If the integrity of the second carcass is in doubt, the hose should be retired from service.

4.4.3 *Fittings*

Exposed internal and external surfaces of flanges and nipples should be cleaned and examined for cracks or excessive corrosion. Either condition should cause the hose to be retired from service.

Double carcass hose leak detection system fittings should similarly be inspected and replaced as necessary.

4.4.4 *Liner*

Visual inspection should be made of the interior for blisters, bulges or separation of the tube from the carcass. Serious defects should be cause for retirement of the hose from service.

Minor defects should be re-examined during the vacuum test.

For hose of a sufficiently large bore, it is recommended that a person physically examine the full length interior of the hose for defects. Adequate safety precautions to ensure safety of personnel should be taken whilst conducting this inspection.

4.5 *Testing of Hoses on Shore*

It is recommended that individual sites build up a statistical database of wear, damage and failure frequency rates by comprehensive testing, including burst testing, in order to establish appropriate retirement criteria and an on-shore testing cycle. Until such criteria have been established, it is recommended that hoses initially be periodically tested to the following schedule:

Type of Hose	Initial Test Interval
Floating	1 to 3 Years
Submarine	1 to 3 Years
Tanker Rail	6 Months to 1 Year
First Off the Buoy	6 Months to 1 Year

It is known that at some locations, hoses remain satisfactorily in service for ten years or more. Criteria, such as this length of service life, can only be established by a statistical database as discussed in the preceding paragraph.

4.5.1 *Hydrostatic Test*

Each hose should be pressure tested with water to its stated pressure rating. The procedure should be as follows:

- Lay out the hose as straight as possible on supports that permit the hose to elongate freely.
- Fill with water, venting to remove all air, and apply a pressure of 0.7 bar.
- Measure the overall length of the hose assembly.
- Increase the pressure over a period of 5 minutes, from 0.7 bar to one half of the rated pressure. Hold this pressure for 30 minutes, then reduce the pressure over a period of 5 minutes to zero.
- Raise the pressure over a period of 5 minutes to the rated pressure and hold.
- Before releasing the full test pressure, measure the overall length of the hose assembly to ascertain the temporary elongation and record the increase as a percentage of the original length measured at 0.7 bar.
- Reduce the pressure over a period of 5 minutes to zero.
- After an interval of at least 15 minutes raise the pressure again to 0.7 bar.
- Measure the overall length of the hose assembly to ascertain the permanent elongation. Record the increase as a percentage of the original length measured at 0.7 bar.
- Release the pressure and drain the hose.

Test records should be kept of each hose so that the temporary elongation under pressure can be compared to the original test and subsequent routine tests. When the temporary or permanent elongation of a wire helix type hose, as evidenced by the field test, exceeds the factory test, temporary or permanent elongation respectively, by 2% of the overall length, the hose should be retired from service. For other types of hose, such as helix free hose, acceptable temporary or permanent elongation should be established by the statistical analysis of site specific test data.

The secondary carcass of some types of double carcass hose may be tested at this time with air pressure. Manufacturers recommendations should be referred to.

4.5.2 *Electrical Continuity Test*

This test should be carried out on all hose removed from service for hydrostatic pressure tests. For electrically bonded hose, continuity should exist during and after the hydraulic test. (Refer to the OCIMF publication entitled "*Guide to Purchasing, Manufacturing and Testing of Loading and Discharge Hoses for Offshore Moorings*"). For electrically discontinuous hose, the resistance between the end nipples of each length of hose should not be less than 25,000 Ohms.

4.5.3 *Vacuum Test*

This test should be carried out on hoses removed from service for hydrostatic pressure tests. Seal off both ends with transparent Plexiglas plates of sufficient strength, using putty as a sealant or bolt up using a soft rubber gasket. One plate should be fixed for connection to a vacuum source. Lay a flashlight in this end with its beam directed toward the opposite end. An inspection mirror using sunlight may also be manipulated from outside the plates to provide an alternative light source. Apply a vacuum of at least 510 millibar gauge, and preferably 680 millibar gauge, for a period of 10 minutes. Inspect the interior of the hose for blisters or bulges. Irreparable blisters, bulges or separation of the tube from the carcass or any tear, cut or gouge through the tube is cause to retire the hose from service.

Repairs to hoses should only be carried out in accordance with the original Manufacturer's instructions, or in consultation with the original manufacturer.

4.6 Testing of Retired Hose

Consideration should be given to destruction testing of retired hose either by pressure bursting or sectioning (cutting up). The data gained can be used to establish suitability for purpose, to gauge the extent of any damage and may provide useful data when determining hose service life and retirement criteria.

Double carcass hoses can be burst in order to test secondary carcass containment and the effectiveness of primary carcass leak detection methods.

All data obtained should be recorded in the hose record system.

5. RECORDS AND FORMS

The keeping of adequate records on the history and performance of the individual hose components is a prerequisite for the efficient operation and maintenance of offshore mooring facilities. Proper records and inventories are necessary for the following reasons:

- To provide operating personnel with a ready record of hoses that are on order, available on site as back-up spares, installed and operating on site or are damaged and taken out of service.
- To permit the operators to assess the quality of performance of the hose and thus provide a basis for future selection and purchases.
- To pinpoint design inadequacies by focusing on hoses in the system that are prone to failure, damage or excessive wear.
- To provide a rational basis for the establishment of anticipated service life and the stockpiling of back-up hoses.
- To exercise any manufacturer's warranties that may apply.
- To meet requirements of local governmental regulations.

There are many different types of hose record systems in use. A manual card system is clear, brief and easy to maintain. It should, however, be considered as the minimum requirement. Computer users may consider use of the OCIMF software "HOSETRAC".

"HOSETRAC" is a computerized guide and administration system for the handling, storage, inspection and testing of hoses in the field. "HOSETRAC" is used to assist in planning, monitoring, analysing and the administration of hoses at marine terminals.

It has been found by many users that oil and water throughput data is of less relevance to hose life than service time data. Recording throughput quantities on paper is very laborious and for this reason the card system does not record this data.

Where it is considered desirable to record throughput, it is suggested that a simple spreadsheet is developed to perform the repetitive additions, alternatively use "HOSETRAC".

5.1 Hose Performance Card System

The suggested card system is described here for use as a minimum standard. The system is composed of the following components:

- The "Hose Card Disposition File" (HCDF)
- The "Hose Performance Card" (with front and rear faces).

5.2 Hose Card Disposition File (HCDF)

WAREHOUSE
MARINE YARD
ALPHA BERTH
BRAVO BERTH
CHARLIE BERTH
DELTA BERTH
ECHO BERTH
ETC.
SCRAP YARD 1
SCRAP YARD 2

COMMENTS:

- The "Hose Card Disposition File" is a system of "Cardex" file drawers, or a similar system, whereby "Hose Performance Cards" may be filed separately, in order and in the categories listed above, i.e. Warehouse, Marine Yard, Berths, Scrap and any other general disposition that is employed at the particular site.
- The "Cardex" file system is recommended as the most convenient and manageable.

- The file system must match the actual hose system configuration at a particular berth. For instance, at an SBM with two floating and underbuoy hose systems, the number of sections (drawers or pockets) in each berth category file must be at least equal to the sum of the floating and underbuoy hoses in each berth string (approximately 40 per string for an SBM).

- When the location of a hose section is changed on site, the "Hose Performance Card" must be shifted to the appropriate position in the "Hose Card Disposition File". When the hose section is in berth service, in addition to having the "Hose Performance Card" filed in the appropriate berth file, it must also be filed in the same sequence as it occurs in the hose string.

- The "Hose Card Disposition File" must, at all times, reflect the actual location of each hose delivered to the terminal. Any changes in location must be posted immediately.

HOSE PERFORMANCE CARD **(Front Face)**

(1) SERIAL NUMBER

(2)

MANUFACTURER	TYPE	SIZE/LENGTH	DELIVERY DATE

HOSE SERVICE

Position	Date Installed	Date Removed	Service Term	Total Service	Reason For Move
(3)					
(4)					

COMMENTS: (Front face only)

- Make out one "Hose Performance Card" for each individual hose.

- Fill in Lines 1 and 2 on this face when the hose section is received on site.

- Fill in Line 3 when the hose section enters service.

- Fill in Line 4, etc. when the hose is moved or subsequently retired

- File the "Hose Performance Card" at all times in the "Hose Card Disposition File" in the category representing the actual location of that particular hose. Shift the position of the "Hose Performance Card" to match any change in its general disposition or location within a hose string. When the hose section is in berth service the "Hose Performance Cards" should be maintained in the same file sequence as their actual sequence at the berth. This permits ready reference, minimizes the chance of error in recording and makes for an orderly, efficient record-keeping sequence.

- List floating hose separately from underbuoy hose. Number floating hose sections in order from the buoy (section 1) to the tanker rail hose. List underbuoy hose in order from the sea floor manifold (section 1) to the connection to the bottom of the buoy.

- When space is exhausted on one card, attach a second card.

TEST DATA **(Reverse Face)**

	Date	Length At Start (L1)	Length At Test Pressure (L2)	Length At Finish (L3)	Temporary Elongation %	Permanent Elongation %	Vacuum Test	Electrical Test (Ohms)
1								
2								

$$\text{Temporary Elongation} = \frac{(L2 - L1)}{L1} \times 100 \quad \text{Permanent Elongation} = \frac{(L3 - L1)}{L1} \times 100$$

VISUAL INSPECTION/COMMENTS

COMMENTS: (Reverse face only)

- Fill in line 1 with the "factory test data" for each hose when it arrives on site. The "factory test data" is fully outlined on the hose test certificate which is supplied with every hose.

- Fill in line 2, etc.
  Upon completion of annual or periodic inspections, the "Test Data" and "Visual Inspection/Comments" sections should be filled in where appropriate.

- When the hose section is ultimately retired the "Visual Inspection/Comments" column will indicate this and the card should be placed in the scrap yard file.

- When space is exhausted, attach a second card.

5.3 Example Application of Proposed Hose Records

	Hose Life Sequence	**Hose Record Sequence**
1.	Hose is ordered, manufactured, and delivered to site where it is held in warehouse stock.	Upon receipt, a "Hose Performance Card" is initiated for each hose and filed in the warehouse section of the "Hose Card Disposition File"
2.	At a later date, a hose is moved to the marine yard for ready back-up supply.	The "Hose Performance Card" is shifted in "Hose Card Disposition File" from Warehouse to Marine Yard.
3.	In the course of emergency repairs the hose is installed in the number 8 position of the 25 section left line of Berth Charlie (Position C-L 8/25)	The "Hose Performance Card" is shifted in the "Hose Card Disposition File" from Marine Storage to Berth Charlie and placed in the pocket relative to the position occupied by the hose in the floating string.
4.	Following the failure of the hose in C-L 4/25, the loading line is placed back in operation by shifting all hoses forward.	The "Hose Performance Card" moves to its new relative position in the Berth Charlie Cardex of the "Hose Card Disposition File".
5.	The entire C-L string is taken out of service for annual testing. The sample hose is returned to the Marine Yard for spare use.	The "Hose Performance Card" is shifted in the "Hose Card Disposition File" from Berth Charlie to the Marine Yard. Inspection results are noted in line 2 of the "Hose Performance Card" (test data - reverse side)
6.	The sample hose is removed from the Marine Yard and inserted as a make-up section in the 14th position on the right line of Berth Alpha (position A-R 14/25)	The "Hose Performance Card" is shifted in the "Hose Card Disposition File" from Marine Storage to Berth Alpha and placed in the pocket relative to the position occupied by the hose in the floating string.
7.	A bulge is noted in the sample hose during routine berth maintenance. The hose is removed, inspected and retired to Scrap Yard 1.	Inspection results and the reasons for retirement are noted on the "Hose Performance Card". The "Hose Performance Card" is shifted in "Hose Card Disposition File" from Berth Alpha to Scrap Yard 1.