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4.0 INDUSTRIAL VIABILITY

4.1 IS THE SHIP BREAKING/RECYCLING INDUSTRY VIABLE?

The ship breaking/recycling industry is a risky, highly speculative[1] business in which bids are made "by the seat of [the] pants."[2] The answer to the question of whether the ship breaking/ recycling industry is viable is a qualified "yes." The qualifications, however, are numerous. The matter turns on the interactions of (1) the volume of tonnage regularly available to the recycler; (2) the rationalization of the selling and contract monitoring process; (3) the rationalization of the environmental rules with respect to the peculiar nature of the maritime endeavor; and (4) the rational transfer of cost and liability from the government owner to the recycler. Each of these will be discussed in turn.

4.1.1 Volume of Tonnage

It is clear that economies of scale will be helpful to the sustainment of the industry. Regular, predictable and adequate tonnage for recycling is necessary.

4.1.1.1 Regularity of Tonnage Supply

In order to either (1) invest new capital in resources or (2) allocate existing capitalized resources to a program of ship breaking/recycling, there must be a predictable regularity of supply. In other words, there can be some economies of scale if there is a regular supply for the demand. This has not been the case heretofore for MARAD-owned ships. If a $2.5 million dollar new investment[3] is necessary for advanced technology equipment such as shears and new methods of shipbreaking and handling, at 8% interest, some $200,000 per year is the required payment to the financier.[4] Assuming that this mid-cost scenario extends over 60 calendar days for one 7684-ton ship and no other ships are envisioned, the interest cost absorbable by the project for the year is $4.34 per LSW ton for the 2 months of work. The general and administrative cost, where interest is properly classified, is increased by $16,667 per month. With no ships to absorb this cost, two things happen. First, bid prices become lower and lower to recompense the cost of capital investment. Second, at some time the recycler will find another business since there is no reliable supply of feedstock on which to use his capital investment. Therefore, it is necessary that a regular and predictable supply of ships be available to maintain the ship breaking/recycling industry.

Maintaining Supply. A simple way to maintain supply is for MARAD to offer ships for recycling in lots of, say, six per lot every 3 months. This induces stable investment into

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[1] For an excellent summary of the nature of the business, see Munro Drydock, Inc. v. M/V *Heron*. 467 F. Supp. 513.

[2] Ibid.

[3] Maritime Administration, Report MA-ENV-820-96003-C, *Current and Advanced Technologies for the Ship Breaking/Recycling Industry*, July 1997.

[4] U.S. and state tax considerations are beyond the scope of this report.

resolution of the domestic recycling problem. Such administrative actions, to be discussed in greater detail in this chapter, would cost MARAD little.

Enhancing Demand. Demand for MARAD ships that are candidates for scrapping also could be enhanced by legislative fiat allowing MARAD to guarantee loans for the purpose of acquiring equipment for environmentally compliant ship breaking/recycling.

Labor Productivity Technology Not Necessarily the Answer. All the above being said, technology is not the complete answer to the recycling question. This turns on the matter of cost. Assuming that direct labor costs the recycler $29.33 per LSW ton, as described above, a target of direct labor cost reduction through productivity increase of $20.00 per LSW ton is not unreasonable. Assuming that the recycler chooses cutting technology as the source of this labor productivity, and assuming that his target is met, the costs attendant to the new technology must be considered. If the new technology costs $100,000 per year ($8,333 per month) in interest, and 60 calendar days are required to recycle a MARINER-class hull, the $9.33 savings in labor per LSW ton is offset by $2.17 in interest. Use of a cutting technology requiring twice as much fuel than older technology decreases the savings by an additional $2.00 per LSW ton. Further, assume that the machine requires $1.00 per LSW ton in additional maintenance over older technology. The net result in labor productivity from this simple exercise is $4.16, which is about the same as the cost of personnel protection. The target is only half-way met by technology of this sort, and clearly labor productivity gains alone will not make recycling profitable. And, as discussed above, this investment will not be made without a regular supply of ships being available to justify the new technology.

Revenue-Enhancing Technologies. It is clear that productivity techniques may make the recycling business more nearly viable. However, the greatest benefit can come from revenue-enhancing techniques that are possible through new technology. The two principal revenue streams from a recycled ship come from ferrous scrap and cuprous scrap. The intrinsic value of cuprous scrap makes it the more attractive candidate for revenue enhancement. Further, given that cuprous scrap is entwined with PCB regulation, a partial solution to the PCB disposal matter has substantial implications for the viability of the recycling industry. Copper wire will be taken as an example.

Copper and PCBs. The matter of copper and its presumed contamination with PCBs is discussed at length elsewhere,[5] as have various waste stream destruction technologies.[6] The vitrification technology appears to have a great deal of merit. Simply put, if a way can be found to maximize copper revenues to that of near-market prices, ship breaking/recycling becomes substantially more attractive to a recycler. Copper wire is an example. Approximately 20 tons (44,800 pounds) of copper wire are found in a MARINER-class vessel. Of this, approximately 80% is copper by weight and 20% is presumed to be PCB-contaminated insulation. This then leaves 35,840 pounds of pure copper available for sale. Currently, the bid price for high-grade copper

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[5] Maritime Administration, Report MA-ENV-820-96003-E, *Survey of Ships and Materials*, July 1997.

[6] Maritime Administration, Report MA-ENV-820-96003-C, *Current and Advanced Technologies for the Ship Breaking/Recycling Industry*, July 1997.

wire contaminated with PCBs is $0.10 per pound, which gives a revenue of $3584 per ship or $0.46 per LSW ton. Essentially, then, the wire is fluff. If copper can be inexpensively decontaminated and sold at, say, $1.00 per pound after transportation costs and other transaction costs, the potential revenue obtainable by selling the wire will be $35,840, or $4.66 per LSW ton. This tenfold increase becomes quite dramatic when applied to all copper found on a ship.

Vitrification. Vitrification is the process of creating a thermally active mass of silicon (molten glass), which is self-sustaining at a critical heat. The insertion of copper wire into this mass results in (1) gasification of PCBs and (2) liquefaction of metallic components of the wire. Due to the different specific densities of the metals and the glass, it is theoretically possible to tap off the copper as a pure metal. All other materials are solidly formed into the cooled vitreous material, which resembles obsidian. This material is inert for practical purposes. Further, there is no reason to limit the input copper-bearing materials to wire. Motor and generator armatures could just as well be considered.

Other Thermal Reduction Methods. There are other technologies available that can heat the copper and allow extraction. Similarly, nonthermal methods such as wire stripping are available. Many of these technologies are under development in the waste-stream reduction industry. Ship breaking/recycling alone is incapable of the capital investment necessary to produce such machines, but a broader base of funding may well bode well for ship copper wire and other copper.

4.1.2 Rationalization of the Selling and Contract Monitoring Process

The current process of offering candidates for recycling under Invitation for Bid (I.F.B.) rules[7] provides limited flexibility for arriving at unique solutions and discourages development of the recycling industry. A modified I.F.B. procedure could be used to greater benefit, or, better yet, a request-for-proposals (R.F.P.)[8] system should be used.

4.1.2.1 Selling Under Invitation-for-Bid Rules

In I.F.B. selling, the variability of the enforcement of the environmental laws on ship breaking/recycling with respect to hazardous materials produces artificially low bids. Additionally, there is insufficient flexibility in the I.F.B. process, as set out in the Federal Acquisition Regulations (FARs), to accommodate innovative bidding strategies and negotiations. This inflexibility drives bid prices down so that bidders can maintain a reasonable margin in the event that an unanticipated cost, such as an unplanned hazardous material removal, occurs. With the exception of some fairly simple rules relating to "responsive and responsible" bidders, the government has little control over the subsequent process of environmentally compliant ship scrapping. In response to this situation, MARAD currently requires a compliance plan to be submitted with any bid. The intent of this plan is to provide MARAD with information on the

[7] 48 CFR 14.

[8] 48 CFR 15.

bidders' environmental management strategies with regard to materials generated during ship scrapping operations.

4.1.2.2 Selling Under Request-for-Proposal Rules

In this method of selling, some technical assessment of the recycler's plans for recycling as well as the costs he proposes can be assessed by the seller. Negotiation is possible between buyer and seller. This method allows technically and financially marginal recyclers to be weeded out so that responsible and well-financed recyclers can perform the function of recycling. This process further allows the government substantial control of the disposition process, with a higher probability of successful disposal than the I.F.B. method.

4.1.2.3 Rationalization of Environmental Rules

It is clear from Chapter 3 that the benefits of environmental regulation outweigh the costs of such regulation if the costs are reasonable and reasonably applied. It appears, however, that such regulation has not fully dealt with the problems of ship breaking/recycling.[9] (The PCB problem is one example of this difficulty.) PCBs have been stringently regulated in commerce. The difficulty is in applying regulations that were developed for either generic problems or land-based matters to the problems of ship breaking/recycling. Exemptions have been granted to entire industries with respect to disposal of discarded products as potentially PCB-contaminated waste.[10] The reason for this is beyond the scope of this report. However, in the exemption of such industries, consideration presumably was made of a number of factors including the technical merit associated with the exemption.

Notwithstanding, shipborne PCB-contaminated waste is not now exempt from the application of PCB regulations. The method of sampling prescribed by the EPA for PCBs, as described elsewhere,[11] is expensive, time consuming and may not accurately depict PCB contamination in vessels.

The existing regulations invite "Region shopping"[12] and even less savory methods of interpretive action by financially marginal recyclers. One appropriate method MARAD may consider is providing a detailed survey of PCB-bearing locations to the recycler which the recycler can rely upon in formulating his bid and in negotiating with EPA for his environmentally compliant scrapping plan. This would increase the viability of the industry. Another method would be for MARAD to develop an appropriate PCB-controlling procedure and negotiate with the EPA to permit it in the case of ship breaking/recycling.

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[9] Maritime Administration, Report MA-ENV-820-96003-A, *The Legal Environment for Environmentally Compliant Ship Breaking/Recycling in the United States*, July 1997.

[10] E.g., automobile scrapping and white goods scrapping.

[11] Maritime Administration, Report MA-ENV-820-96003-E, *Survey of Ships and Materials*, July 1997.

[12] This is the process of negotiating various regulatory matters in different EPA Regions, looking for the most lenient Region.

4.1.2.4 Transfer of Cost and Liability

MARAD may have less difficulty selling its ships for recycling if it can adopt alternative methods for the transfer of ships.

Tanks and Bilges Clean and Gas-Free. A substantial cost to the recycler (see Chapter 3) is accepting a ship "as is, where is" and then being responsible for the cleaning and gas-freeing of the ship for (1) hot work and (2) disposal of the effluent from the tankage. Typically this cost is considered in the bid and can significantly reduce the bid price. By presenting the ships clean and gas-free to the recycler, MARAD may be able to increase the return for its ships. Presentation of the ship in this condition may increase the initial preparation costs to the government, but these costs must be balanced against the potential increased return. Moreover, the funds to perform such work may not be available in current budgets.

Clean of Asbestos. As discussed above, the cleaning of a ship of asbestos is a well-known process but adds substantial cost to the recycler. Most shipyards are adept in asbestos-cleaning processes, as are a number of independent contractors. MARAD could provide clean candidate vessels for sale. The combination of an asbestos-clean and tank-clean and gas-free ship enhances the recycling economies substantially and may enable MARAD to increase the return for its ships. Once again, however, presentation of the ship in this condition may increase the initial preparation costs to the government, but these costs must be balanced against the potential increased return.

PCBs and Other Hazardous Materials Identified. PCB-containing materials must be removed during the reduction process. Accordingly, it would create substantially less uncertainty to the recycler if MARAD were able to provide a PCB and Other Hazardous Materials Survey Report on the ships to be sold. This would allow for a more equitable bid process in competition. Such a survey could be costly but might enable MARAD to increase the return for its ships.

4.2 SCENARIOS FOR SHIP BREAKING/RECYCLING

Several scenarios can be developed for recycling ships in the United States. Each is illustrative of some of the matters expressed in this chapter.

4.2.1 Do-Nothing Scenario

An intuitively appealing but wholly impracticable scenario would be to continue to maintain MARAD's scrap candidate ships in the Reserve Fleets as they have been maintained in the past. This is not an option, however, inasmuch as the National Maritime Heritage Act uses the mandatory language "shall sell"[13] with respect to MARAD's disposition of the candidate ships. Accordingly, this option is not developed further in this report.

[13] 16 U.S.C.S. 5401.

4.2.2 Selling "Clean"

It is clear that the removal of tankage, removal of asbestos, and removal of PCB-bearing fluff are principal noncontrollable cost drivers for ship breaking/recycling. Table 7 shows how obtaining ships with tanks clean and gas free and the ship asbestos free and with PCBs identified impact costs in the middle-range cost and revenue case. Such cleaning makes recycling substantially more viable as an industrial process.

Table 7. Profits in $/LSW-LT for Clean Delivery of Ships by MARAD

Clean of Asbestos	
Expected Revenue (Mid-Range) Direct Cost Asbestos Removal by MARAD Indirect Cost	135 (125) 20 (34)
Profit Before Tax and Interest	(4)
Tanks Clean and Gas-Free	
Expected Revenue (Mid-Range) Direct Cost Tank Cleaning by MARAD Indirect Cost	135 (125) 35 (34)
Profit Before Tax and Interest	11

4.2.3 Enhancing Revenue with Technology

Table 8 compares the middle-range cost scenario with enhanced productivity and revenue produced from copper-recovery technological applications and no "clean" delivery. Such changes make the recycling industry more attractive than now. The enhanced revenue values in Table 8 are a result of the revenue values presented in Table 5 plus $20/LSW-ton revenue increase due to higher productivity and lower labor costs (see Section 4.1.1.1 for details).

Table 8. Profits in $/LSW-LT from Technology-Enhanced Copper and Ferrous Scrap and Other Revenues with Ships Sold in Unmodified Condition

	Low	Middle	High
Enhanced Revenue	145	155	165
Cost (Direct and Indirect) No transfer	148	159	170
Net Profit Before Tax and Interest	(3)	(4)	(5)

4.2.4 Selling for Non-Transportation Purposes

The hulls of a number of the Reserve Fleet ships are of adequate soundness to find buyers for non-transportation purposes. For example, one party in the United States is actively engaged in the business of buying naval hulls and converting them to floating electrical generation platforms for sale of electricity outside the United States.[14] MARAD hulls might well be able to perform similar non-transportation uses if marketed and if MARAD were to develop ways to encourage such innovative use in the market.[15]

4.2.5 General Caution

None of the scenarios described above will make certain the viability of the ship breaking/ recycling market in the United States, as will be discussed below. Neither are there sufficient data to draw more than speculative conclusions that MARAD will receive sufficient monies from bidders to recoup the costs attendant to the sales scenarios discussed above.

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[14] Florida Aggregates Co., Inc.

[15] The Maritime Administration has long had interest in floating production plants and other kinds of floating industrial platforms. This interest could be translated to placing such plants and activities on obsolete hulls which are candidates for scrapping.

4.3 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations can be stated succinctly. Several steps could be taken to enhance the viability of the ship breaking/recycling industry.

4.3.1 Clean Ships

Ships could be cleaned to some extent prior to sale for disposal. MARAD should consider offering its ships to the recycling market with tanks clean and gas free and with asbestos removed and with a Survey of PCBs and Other Hazardous Materials Report. This could potentially allow MARAD to increase the return for its ships and make ship breaking/recycling profitable to the recycler. This activity would increase the initial preparation costs to the government; however, these costs must be balanced against the potential increased return.

4.3.2 Technically Managed Scrapping

MARAD should sell its ships to the recycler who offers a technically acceptable proposal and who is financially and experientially capable of performing the scrapping according to his/her proposal.

4.3.3 Volume of Ships

MARAD could offer its ships in groups of no fewer than six vessels at a time on a regularly scheduled basis.

4.3.4 Technology

MARAD could investigate thermal reduction technologies for the efficient destruction of hazardous materials and the simultaneous recovery of base metals in ship breaking/recycling. This longer-range concept could perhaps be repaid to MARAD in a substantial rise in bid prices for hulls.

4.3.5 Other Matters

MARAD should consider a program of financial guarantees for the acquisition of equipment for efficient and environmentally compliant ship scrapping. Further, MARAD should work with EPA to determine procedures for environmentally sound ship breaking/recycling that are acceptable to both parties and that recognize the peculiarities of the maritime endeavor.

APPENDIX 1

U.S. IRON AND STEEL SCRAP SPECIFICATIONS

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US iron and steel scrap specifications

The following specifications are reproduced by courtesy of the Institute of Scrap Recycling Industries Inc (Isri). Additional information or copies of the complete specification can be obtained from the Institute of Scrap Recycling Industries Inc, 1325 G. Street NW, Suite 1000, Washington, DC 20005-3104, USA. (Fax: +1 (202) 775 9109).

General

a. **Cleanness.** All grades shall be free of dirt, non ferrous metals, or foreign material of any kind, and excessive rust and corrosion. However, the terms 'free of dirt', non ferrous metals, or foreign material of any kind, are not intended to preclude the accidental inclusion of negligible amounts where it can be shown that this amount is unavoidable in the customary preparation and handling of the particular grade involved.

b. **Off-grade material.** The inclusion in a shipment of a particular grade of iron and steel scrap of a negligible amount of metallic material which exceeds to a minor extent the applicable size limitations, or which fails to a minor extent to meet the applicable requirements as to quality or kind of material, shall not change the classification of the shipment, provided it can be shown that the inclusion of such off-grade material is unavoidable in the customary preparation and handling of the grade involved.

c. **Residual alloys.** Wherever the term 'free of alloys' is used in the classifications given herein, it shall mean that any alloys contained in the steel are residual and have not been added for the purpose of making an alloy steel. Steel scrap shall be considered free of alloys when the residual alloying elements do not exceed the following percentages: Nickel 0.45%; Chromium 0.20%; Molybdenum 0.10%; Manganese 1.65%. The combined residuals other than manganese shall not exceed a total of 0.60%.

d. **Deviations.** Any deviations from the general classifications of iron and steel scrap may be consummated by mutual agreement between buyer and seller.

Code No.

200 **No. 1 heavy melting steel.** Wrought iron and/or steel scrap ¼ in. and over in thickness. Individual pieces not over 60 in. x 24 in. (charging box size) prepared in a manner to insure compact charging.

201 **No. 1 heavy melting steel 3 ft. x 18 in.** Wrought iron and/or steel scrap ¼ in. and over in thickness. Individual pieces not over 36 in. x 18 in. (charging box size) prepared in a manner to insure compact charging.

202 **No. 1 heavy melting steel 5 ft. x 18 in.** Wrought iron and/or steel scrap ¼ in. and over in thickness. Individual pieces not over 60 in. x 18 in. (charging box size) prepared in a manner to insure compact charging.

203 **No. 2 heavy melting steel.*** Wrought iron and steel scrap, black and galvanized, ⅛ in. and over in thickness, charging box size to include material not suitable as No. 1 heavy melting steel. Prepared in a manner to insure compact charging.

204 **No. 2 heavy melting steel.*** Wrought iron and steel scrap, black and galvanized, maximum size 36 in. x 18 in. May include all automobile scrap properly prepared. *The identical designations given for these two classifications are in accordance with established industry practices in specifying the materials desired.

205 **No. 2 heavy melting steel 3 ft. x 18 in.** Wrought iron and steel scrap, black and galvanized, maximum size 36 in. x 18 in. May include automobile scrap, properly prepared, however, to be free of sheet iron or thin gauged material.

206 **No. 2 heavy melting steel 5 ft. x 18 in.** Wrought iron and steel scrap, black and galvanized, maximum size 60 in. x 18 in. May include automobile scrap, properly prepared, however, to be free of sheet iron or thin gauged material.

207 **No. 1 busheling.** Clean steel scrap, not exceeding 12 in. in any dimensions, including new factory busheling (for example, sheet clippings, stampings, etc.). May not include old auto body and fender stock. Free of metal coated, limed, vitreous enameled, and electrical sheet containing over 0.5% silicon.

207A **New Black Sheet Clippings.** For direct charging, max. size 8 ft. x 18 in., free of old automobile body and fender stock, metal coated, limed, vitreous enameled and electrical sheet containing over 0.5% silicon, must lay reasonably flat in car.

208 **No. 1 bundles.** New black steel sheet scrap, clippings or skeleton scrap, compressed or hand bundled, to charging box size, and weighing not less than 75 lb. per cubic foot. (Hand bundles are tightly secured for handling with a magnet). May include Stanley balls or mandrel wound bundles or skeleton reels, tightly secured. May include chemically detinned material. May not include old auto body or fender stock. Free of metal coated, limed, vitreous enameled, and electrical sheet containing over 0.5% silicon.

209 **No. 2 bundles.** Old black and galvanized steel sheet scrap, hydraulically compressed to charging box size and weighing not less than 75 lb. per cubic foot. May not include tin or lead-coated material or vitreous enameled material.

210 **Shredded scrap.** Homogeneous iron and steel scrap, magnetically separated, originating from automobiles, unprepared No. 1 and No. 2 steel, miscellaneous baling and sheet scrap. Average density 50 lb. per cubic foot.

US iron & steel scrap specifications (continued)

211 **Shredded scrap.** Homogeneous iron and steel scrap magnetically separated, originating from automobiles, unprepared No. 1 and No. 2 steel, miscellaneous baling and sheet scrap. Average density 70 lb. per cubic foot.

212 **Shredded clippings.** Shredded 1000 series carbon steel clippings or sheets. Material should have an average density of 60 lb. per cubic foot.

213 **Shredded Tin Cans for Remelting.** Shredded steel cans, tin coated or tin free, may include aluminium tops but must be free of aluminium cans, non ferrous metals except those used in can construction, and non-metallics of any kind.

214 **No. 3 bundles.** Old sheet steel, compressed to charging box size and weighing not less than 75 lb. per cubic foot. May include all coated ferrous scrap not suitable for inclusion in No. 2 bundles.

215 **Incinerator bundles.** Tin can scrap, compressed to charging box size and weighing not less than 75lb. per cubic foot. Processed through a recognized garbage incinerator.

216 **Terne plate bundles.** New terne plate sheet scrap, clippings or skeleton scrap, compressed or hand bundled, to charging box size, and weighing not less than 75 lb. per cubic foot. (Hand bundles are tightly secured for handling with a magnet.) May include Stanley balls or mandrel wound bundles or skeleton reels, tightly secured.

217 **Bundled No. 1 steel.** Wrought iron and/or steel scrap 1/8 in. or over in thickness, compressed to charging box size and weighing not less than 75 lb. per cubic foot. Free of all metal coated material.

218 **Bundled No. 2 steel.** Wrought iron or steel scrap, black or galvanized, 1/8 in. and over in thickness, compressed to charging box size and weighing not less than 75 lb. per cubic foot. Auto body and fender stock, burnt or hand stripped, may constitute a maximum of 60% by weight. (This percent based on makeup of auto body, chassis, driveshafts, and bumpers.) Free of all coated material, except as found on automobiles.

219 **Machine shop turnings.** Clean steel or wrought iron turnings, free of iron borings, non ferrous metals in a free state, scale, or excessive oil. May not include badly rusted or corroded stock.

220 **Machine shop turnings and iron borings.** Same as machine shop turnings but including iron borings.

221 **Shoveling turnings.** Clean short steel or wrought iron turnings, drillings, or screw cuttings. May include any such material whether resulting from crushing, raking, or other processes. Free of springy, bushy, tangled or matted material, lumps, iron borings, non ferrous metals in a free state, grindings, or excessive oil.

222 **Shoveling turnings and iron borings.** Same as shovelling turnings, but including iron borings.

223 **Iron borings.** Clean cast iron or malleable iron borings and drillings, free of steel turnings, scale, lumps, and excessive oil.

224 **Auto slabs.** Clean automobile slabs, cut 3 ft. x 18 in. and under.

225 **Auto slabs.** Clean automobile slabs, cut 2 ft. x 18 in. and under.

226 **Briquetted iron borings.** Analysis and density to consumer's specifications.

227 **Briquetted steel turnings.** Analysis and density to consumer's specifications.

228 **Mill scale.** Dark colored, ranging from blue to black, ferro-magnetic iron oxide forming on the surface of steel articles during heating and working.

Electric Furnace Casting, and Foundry Grades

229 **Billet, bloom and forge crops.** Billet, bloom, axle, slab, heavy plate and heavy forge crops, containing not over 0.05% phosphorus or sulphur and not over 0.5% silicon, free from alloys. Dimensions not less than 2 in. in thickness, not over 18 in. in width, and not over 36 in. in length.

230 **Bar crops and plate scrap.** Bar crops, plate scrap, forgings, bits, jars, and tool joints, containing not over 0.05% phosphorus or sulphur, not over 0.5% silicon, free from alloys. Dimensions not less than ½in. thickness, not over 18 in. in width, and not over 36 in. in length.

231 **Plate and structural steel, 5 ft. and under.** Cut structural and plate scrap, 5 ft. and under. Clean open hearth steel plates, structural shapes, crop ends, shearings, or broken steel tires. Dimensions not less than ¼ in. thickness, not over 5 ft. in length and 18 in. in width. Phosphorus or sulphur not over 0.05%.

232 **Plate and structural steel, 5 ft. and under.** Cut structural and plate scrap, 5 ft. and under. Clean open hearth steel plates, structural shapes, crop ends, shearings, or broken steel tires. Dimensions not less than ¼ in. thickness, not over 5 ft. in length and 24 in. in width. Phosphorus or sulphur not over 0.05%.

233 **Cast steel.** Steel castings not over 48 in. long or 18 in. wide, and ¼ in. and over in thickness, containing not over 0.05% phosphorus or sulphur, free from alloys and attachments. May include heads, gates, and risers.

234 **Punchings and plate scrap.** Punchings or stampings, plate scrap, and bar crops containing not over 0.05% phosphorus or sulphur and not over 0.5% silicon, free from alloys. All materials cut 12 in. and under, and with the exception of punchings or stampings, at least 1/8 in. in thickness. Punchings or stampings under 6 in. in diameter may be any gauge.

235 **Electric furnace bundles.** New black steel sheet scrap hydraulically compressed into bundles of size and weight as specified by consumer.

US iron & steel scrap specifications (continued)

236 **Cut structural and plate scrap, 3 ft. and under.** Clean open hearth steel plates, structural shapes, crop ends, shearings, or broken steel tires. Dimensions not less than ¼ in. in thickness, not over 3 ft. in length and 18 in. in width. Phosphorus or sulphur not over 0.05%.

237 **Cut structural and plate scrap, 2 ft. and under.** Same as cut structural and plate scrap, 3 ft. and under, except for length.

238 **Cut structural and plate scrap, 1 ft. and under.** Same as cut structural and plate scrap, 3 ft. and under, except for length.

239 **Silicon busheling.** Clean silicon bearing steel scrap, not exceeding 12 in. in any dimensions, including new factory busheling (for example, sheet clippings, stampings, etc.), having a silicon content of 0.05% to 5.0%.

240 **Silicon clippings.** Clean steel scrap, including new factory busheling (for example, sheet clippings, stampings, etc.), may not include old auto body and fender stock. Free of metal coated, limed, vitreous enameled, and electrical sheet containing minimum 1% silicon.

241 **Chargeable ingots and ingot butts.** Chargeable ingots and ingot butts for material to be suitable and acceptable to the consumer containing not over 0.05% phosphorus or sulphur and not over 0.05% silicon free of alloys.

242 **Foundry steel, 2 ft. and under.** Steel scrap ⅛ in. and over in thickness, not over 2 ft. in length or 18 in. in width. Individual pieces free from attachments. May not include non ferrous metals, cast or malleable iron, cable, vitreous enameled, or metal coated material.

243 **Foundry steel, 1 ft. and under.** Same specifications as 2 ft. material, except for length.

244 **Springs and crankshafts.** Clean automotive springs and crankshafts, either new or used.

245 **Alloy free turnings.** Clean shoveling steel turnings free from lumps, tangled or matted material, iron borings, or excessive oil containing not more than 0.05% phosphorus or sulphur, and free of alloys.

246 **Alloy free short shoveling steel turnings.** Clean shoveling steel turnings, free of lumps, tangled or matted material, iron borings, or excessive oil, containing not more than 0.05% phosphorus or sulphur, and free of alloys.

247 **Alloy free machine shop turnings.** Clean steel turnings, free of iron borings or excessive oil, containing not more than 0.05% phosphorus or sulphur, and free of alloys. May not include badly rusted or corroded stock.

248 **Hard steel cut 30 in. and under.** Automotive steel consisting of rear ends, crankshafts, driveshafts, front axles, springs, and gears prepared 30 in. and under. May not include miscellaneous small shoveling steel or any pieces too bulky for gray iron foundry use.

249 **Chargeable slab crops.** Chargeable slab crops for material to be suitable and acceptable to the consumer containing not over 0.05% phosphorus and 0.05% sulphur and not over 0.05% silicon; free of alloys.

250 **Silicon bundles.** Silicon sheet scrap, clippings or skeleton scrap, compressed or hand bundled, to charging box size, and weighing not less than 75 lb. per cubic foot, having a silicon content of 0.50% to 5.0%.

251 **Heavy turnings.** Short, heavy turnings, containing not over 0.05% phosphorus or sulphur and free of alloys. May include rail chips. May not include machine shop or other light turnings and must weigh not less than 75 lb. per cubic foot in the original state of production.

Specially Processed Grade to Meet Consumer Requirements

Grades of scrap prepared especially to meet with steel mill or foundry requirements, individual specifications to be agreed on between consumer and supplier.

Cast Iron Grades

252 **Cupola cast.** Clean cast iron scrap as columns, pipes, plates, and castings of a miscellaneous nature, including automobile blocks and cast iron parts of agricultural and other machinery. Free from stove plate, burnt iron, brake shoes or foreign material. Cupola size, not over 24 in. x 30 in., and no piece over 150 lb. in weight.

253 **Charging box cast.** Clean cast iron scrap in sizes not over 60 in. in length or 30 in. in width, suitable for charging into an open hearth furnace without further preparation. Free from burnt iron, brake shoes, or stove plate.

254 **Heavy breakable cast.** Cast iron scrap over charging box size or weighing more than 500 lb. May include cylinders and driving wheel centers. May include steel which does not exceed 10% of the casting by weight.

255 **Hammer block or bases.** Cast iron hammer blocks or bases.

256 **Burnt iron.** Burnt cast iron scrap, such as stove parts, grate bars and miscellaneous burnt iron. May include sash weights or window weights.

257 **Mixed cast.** May include all grades of cast iron except burnt iron. Dimensions not over 24 in. x 30 in. and no piece over 150 lb. in weight.

258 **Stove plate, clean cast iron stove.** Free from malleable and steel parts, window weights, plow points, or burnt cast iron.

US iron & steel scrap specifications (continued)

259 **Clean auto cast.** Clean auto blocks; free of all steel parts except camshafts, valves, valve springs, and studs. Free of non ferrous and non-metallic parts.

260 **Unstripped motor blocks.** Automobile or truck motors from which steel and non ferrous fittings may or may not have been removed. Free from driveshafts and all parts of frames.

261 **Drop broken machinery cast.** Clean heavy cast iron machinery scrap that has been broken under a drop. All pieces must be of cupola size, not over 24 in. x 30 in., and no piece over 150 lb. in weight.

262 **Clean auto cast, broken, not degreased.** Clean auto blocks, free of all steel parts except camshafts, valves, valve springs and studs. Free of non ferrous and non-metallic parts, and must be broken to cupola size, 150 lb. or less.

263 **Clean auto cast, degreased.** Free of all steel parts except camshafts, valves, valve springs, and studs. Free of non ferrous and non-metallic parts, and must be broken into cupola size, 150 lb. or less.

264 **Malleable.** Malleable parts of automobiles, railroad cars, locomotives, or miscellaneous malleable iron castings. Free from cast iron and steel parts and other foreign material.

265 **Broken ingot molds and stools.** Broken ingot molds and stools, cast iron, maximum size 2 ft. x 3 ft. x 5 ft.

266 **Unbroken ingot molds and stools.** Unbroken ingot molds and stools, cast iron.

Special Boring Grades

267 **No. 1 chemical borings.** New clean cast or malleable iron borings and drillings containing not more than 1% oil, free from steel turnings, or chips, lumps, scale, corroded or rusty material.

268 **Briquetted cast iron borings, hot process.** Cast iron borings, heated, briquetted, to a density of approximately 85%, oil and water content under 1%.

269 **Briquetted cast iron borings, cold process.** Cast iron boring briquettes, free of steel and non ferrous material, hydraulically compressed into a cohesive solid, reasonably free of oil, and having a density of not less than 60%.

270 **Malleable borings.**Clean malleable iron borings and drillings, free of steel turnings, scale, lumps and excessive oil.

271 **No. 2 chemical borings.** New clean cast or malleable iron borings and drillings, containing not more than 1.5% oil, free from steel turnings, or chips, lumps, scale, corroded or rusty material.

APPENDIX 2

U.S. NON-FERROUS SCRAP SPECIFICATIONS

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US non-ferrous scrap specifications

The following specifications are reproduced by courtesy of the Institute of Scrap Recycling Industries Inc (Isri). Additional information or copies of the complete specification can be obtained from the Institute of Scrap Recycling Industries Inc, 1325 G Street NW, Suite 1000, Washington DC 20005-3104, USA (Fax: +1 (202) 775 9109).

ISRI Code Word	Item
Apple	**Nonferrous Terms.** (a) Delivery of more or less of the specified quantity up to 3 per cent is permissible. (b) A ton shall be understood to be 2000 pounds, unless otherwise specified. (c) If any portion of the goods covered by a contract are unshipped or undelivered within the time specified in a contract, then that portion is subject to cancellation by the buyer, and/or the buyer has the right to hold the seller responsible for substantiated damages. If because of embargo and/or other conditions of force majeure, a delivery or shipment cannot be made by the time specified, the contract shall remain valid and shall be completed promptly upon lifting of the embargo, and/or conditions of force majeure and the terms of said contract shall not be changed. (d) If for any portion of a contract the buyer fails in a timely manner to open a Letter of Credit, and/or fails to provide proper conveyance and/or shipping instructions as specified in the contract, then that portion is subject to cancellation by the seller and/or the seller has the right to hold the buyer responsible for substantiated damages. If, because of embargo and/or other conditions of force majeure, a delivery or shipment cannot be made by the time specified, the contract shall remain valid and shall be completed promptly upon lifting of the embargo, and/or conditions of force majeure and the terms of said contract shall not be changed. (e) If a significant weight or quality difference is apparent, the seller should be notified promptly and, if requested, another weight or quality determination should be taken. Seller and/or buyer should be given the opportunity to appoint an independent surveyor or a representative to verify weights and/or quality. For purposes of this section, the meaning of the word "significant" shall be determined by agreement between buyer and seller, depending on the commodities and their values. (f) If it is mutually determined that goods delivered do not conform to the description specified in the contract, then the shipment is subject to rejection or downgrade. Disposition of, replacement of, and/or financial adjustment for rejected material shall be subjected to mutual agreement between buyer and seller. Seller is responsible for freight costs. Buyer is expected, however, to exert every effort to limit rejections only to that portion of the shipment which is unsortable and to return the rejected portion promptly upon request, if government regulations permit.
Barley	**No. 1 Copper Wire.** Shall consist of No. 1 bare, uncoated, unalloyed copper wire, not smaller than No. 16 B & S wire gauge. Green copper wire and hydraulically compacted material to be subject to agreement between buyer and seller.
Berry	**No. 1 Copper Wire.** Shall consist of clean, untinned, uncoated, unalloyed copper wire and cable, not smaller than No. 16 B & S wire gauge, free of burnt wire which is brittle. Hydraulically briquetted copper subject to agreement.
Birch	**No. 2 Copper Wire.** Shall consist of miscellaneous, unalloyed copper wire having a nominal 96% copper content (minimum 94%) as determined by electrolytic assay. Should be free of the following. Excessively leaded, tinned, soldered copper wire; brass and bronze wire; excessive oil content, iron, and non-metallics; copper wire from burning, containing insulation; hair wire; burnt wire which is brittle; and should be reasonably free of ash. Hydraulically briquetted copper subject to agreement.
Candy	**No. 1 Heavy Copper.** Shall consist of clean, unalloyed, uncoated copper clippings, punchings, bus bars, commutator segments, and wire not less than 1/16 of an inch thick, free of burnt wire which is brittle; but may include clean copper tubing. Hydraulically briquetted copper subject to agreement.
Cliff	**No. 2 Copper.** Shall consist of miscellaneous, unalloyed copper scrap having a nominal 96% copper content (minimum 94%) as determined by electrolytic assay. Should be free of the following: Excessively leaded, tinned, soldered copper scrap; brasses and bronzes; excessive oil content, iron and non-metallics; copper tubing with other than copper connections or with sediment; copper wire from burning, containing insulation; hair wire; burnt wire which is brittle; and should be reasonably free of ash. Hydraulically briquetted copper subject to agreement.
Clove	**No. 1 Copper Wire Nodules.** Shall consist of No. 1 bare, uncoated, unalloyed copper wire scrap nodules, chopped or shredded, free of tin, lead, zinc, aluminum, iron, other metallic impurities, insulation, and other foreign contamination. Minimum copper 99%. Gauge smaller than No. 16 B & S wire and hydraulically compacted material subject to agreement between buyer and seller.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
Cobra	**No. 2 Copper Wire Nodules.** Shall consist of No. 2 unalloyed copper wire scrap nodules, chopped or shredded, minimum 97% copper. Maximum metal impurities not to exceed 0.50% aluminum and 1% each of other metals or insulation. Hydraulically compacted material subject to agreement between buyer and seller.
Cocoa	**Copper Wire Nodules.** Shall consist of unalloyed copper wire scrap nodules, chopped or shredded, minimum 99% copper. Shall be free of excessive insulation and other non-metallics. Maximum metal impurities as follows: Aluminum — .05% Tin — .25% Nickel — .05% Antimony — .01% Iron — .05% Hydraulically compacted material subject to agreement between buyer and seller.
Dream	**Light Copper.** Shall consist of miscellaneous, unalloyed copper scrap having a nominal 92% copper content (minimum 88%) as determined by electrolytic assay and shall consist of sheet copper, gutters, downspouts, kettles, boilers, and similar scrap. Should be free of the following: Burnt hair wire; copper clad; plating racks; grindings; copper wire from burning, containing insulation; radiators, fire extinguishers; refrigerator units; electrotype shells; screening; excessively leaded, tinned, soldered scrap; brasses and bronzes; excessive oil, iron and non-metallics; and should be reasonably free of ash. Hydraulically briquetted copper subject to agreement. Any items excluded in this grade are also excluded in the higher grades above.
Drink	**Refinery Brass.** Shall contain a minimum of 61.3% copper and maximum 5% iron and to consist of brass and bronze solids and turnings, and alloyed and contaminated copper scrap. Shall be free of insulated wire, grindings, electrotype shells and non-metallics. Hydraulically briquetted material subject to agreement.
Drove	**Copper-Bearing Scrap.** Shall consist of miscellaneous copper-containing skimmings, grindings, ashes, irony brass and copper, residues and slags. Free of insulated wires; copper chlorides; unprepared tangled material; large motors; pyrophoric material; asbestos brake linings; furnace bottoms; high lead materials; graphite crucibles; and noxious and explosive materials. Fine powdered material by agreement. Hydraulically briquetted material subject to agreement.
Druid	**Insulated Copper Wire Scrap.** Shall consist of copper wire scrap with various types of insulation. To be sold on a sample or recovery basis, subject to agreement between buyer and seller.
Ebony	**Composition or Red Brass.** Shall consist of red brass scrap, valves, machinery bearings and other machinery parts, including miscellaneous castings made of copper, tin, zinc, and/or lead. Should be free of semi-red brass castings (78% to 81% copper); railroad car boxes and other similar high-lead alloys; cocks and faucets; closed water meters; gates; pot pieces; ingots and burned brass; aluminum, silicon, and manganese bronzes; iron and non-metallics. No piece to measure more than 12" over any one part or weigh over 100 lbs.
Enerv	**Red Brass Composition Turnings.** Shall consist of turnings from red brass composition material and should be sold subject to sample or analysis.
Elder	**Genuine Babbitt-Lined Brass Bushings.** Shall consist of red brass bushings and bearings from automobiles and other machinery, shall contain not less than 12% high tin base babbitt, and shall be free of iron-backed bearings.
Eland	**High Grade—Low Lead Bronze Solids.** It is recommended these materials be sold by analysis.
Elias	**High Lead Bronze Solids and Borings.** It is recommended that these materials be sold on sample or analysis.
Engel	**Machinery or Hard Brass Solids.** Shall have a copper content of not less than 75%, a tin content of not less than 6%, and a lead content of not less than 6%—nor more than 11%, and total impurities, exclusive of zinc, antimony, and nickel of not more than 0.75%; the antimony content not to exceed 0.50%. Shall be free of lined and unlined standard red car boxes.
Erin	**Machinery or Hard Brass Borings.** Shall have a copper content of not less than 75%, a tin content of not less than 6%, and a lead content of not less than 6%—nor more than 11%, and the total impurities, exclusive of zinc, antimony, and nickel of not more than 0.75%, the antimony content not to exceed 0.50%.
Fence	**Unlined Standard Red Car Boxes (Clean Journals).** Shall consist of standard unlined and/or sweated railroad boxes and unlined and/or sweated car journal bearings, free of yellow boxes and iron-backed boxes.
Ferry	**Lined Standard Red Car Boxes (Lined Journals).** Shall consist of standard babbitt-lined railroad boxes and/or babbitt-lined car journal bearings, free of yellow boxes and iron-backed boxes.
Grape	**Cocks and Faucets.** Shall consist of mixed clean red and yellow brass, including chrome or nickel-plated, free of gas cocks, beer faucets, and aluminum and zinc base die cast material, and to contain a minimum of 35% semi-red.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
Honey	**Yellow Brass Scrap.** Shall consist of brass castings, rolled brass, rod brass, tubing and miscellaneous yellow brasses, including plated brass. Must be free of manganese-bronze, aluminum-bronze, unsweated radiators or radiator parts, iron, excessively dirty and corroded materials.
Ivory	**Yellow Brass Castings.** Shall consist of yellow brass castings in crucible shape, no piece to measure more than 12 inches over any one part; and shall be free of brass forgings, silicon bronze, aluminum bronze and manganese bronze, and not to contain more than 15% nickel plated material.
Label	**New Brass Clippings.** Shall consist of the cuttings of new unleaded yellow brass sheet or plate, to be clean and free from foreign substances and not to contain more than 10% of clean brass punchings under ¼ inch. To be free of Muntz metal and naval brass.
Lace	**Brass Shell Cases without Primers.** Shall consist of clean fired 70/30 brass shell cases free of primers and any other foreign material.
Lady	**Brass Shell Cases with Primers.** Shall consist of clean fired 70/30 brass shell cases containing the brass primers and which contain no other foreign material.
Lake	**Brass Small Arms and Rifle Shells, Clean Fired.** Shall consist of clean fired 70/30 brass shells free of bullets, iron and any other foreign material.
Lamb	**Brass Small Arms and Rifle Shells, Clean Muffled (Popped).** Shall consist of clean muffled (popped) 70/30 brass shells free of bullets, iron and any other foreign material.
Lark	**Yellow Brass Primer.** Shall consist of clean yellow brass primers, burnt or unburnt. Free of iron, excessive dirt, corrosion and any other foreign material.
Maize	**Mixed New Nickel Silver Clippings.** Shall consist of one or more nickel silver alloys and the range of nickel content to be specified, free of chrome or any other plating material. Leaded nickel silver clippings should be packed and sold separately. Not to contain more than 10% of clean punchings under ¼ inch.
Major	**New Nickel Silver Clippings and Solids.** Shall consist of new, clean nickel silver clippings, plate, rod and forgings, and other rolled shapes, free of chrome or any other plating material. Must be sold on nickel content specifications such as 10%—12%—15%—18%—20%. Leaded nickel silver clippings should be packed and sold separately. A description as to its physical characteristics should be made in offering all nickel silver material.
Malar	**New Segregated Nickel Silver Clippings.** Shall consist of one specified nickel silver alloy. Not to contain more than 10% of clean punchings under ¼ inch.
Malic	**Old Nickel Silver.** Shall consist of old nickel silver sheet, pipe, rod, tubes, wire, screen, soldered or unsoldered. Must not be trimmed seams alone and it is also to be free of foreign substances, iron rimmed material and other metals.
Melon	**Brass Pipe.** Shall consist of brass pipe free of plated and soldered materials or pipes with cast brass connections. To be sound, clean pipes free of sediment and condenser tubes.
Naggy	**Nickel Silver Castings.** To be packed and sold separately.
Niece	**Nickel Silver Turnings.** To be sold by sample or analysis.
Night	**Yellow Brass Rod Turnings.** Shall consist of strictly rod turnings, free of aluminum, manganese, composition, Tobin and Muntz metal turnings; not to contain over 3% free iron, oil or other moisture; to be free of grindings and babbitts; to contain not more than 0.30% tin and not more than 0.15% alloyed iron.
Noble	**New Yellow Brass Rod Ends.** Shall consist of new, clean rod ends from free turning brass rods or forging rods, not to contain more than 0.30% tin and not more than 0.15% alloyed iron. To be free of Muntz metal and naval brass or any other alloys. To be in pieces not larger than 12 and free of foreign matter.
Nomad	**Yellow Brass Turnings.** Shall consist of yellow brass turnings, free of aluminum, manganese and composition turnings, not to contain over 3% of free iron, oil or other moisture; to be free of grindings and babbitts. To avoid disupute, to be sold subject to sample or analysis.
Ocean	**Mixed Unsweated Auto Radiators.** Shall consist of mixed automobile raidators, to be free of aluminum radiators, and iron finned radiators. All radiators to be subjected to deduction of actual iron. The tonnage specification should cover the gross weight of the radiators, unless otherwise specified.
Pales	**Admiralty Brass Condenser Tubes.** Shall consist of clean sound Admiralty condenser tubing which may be plated or unplated, free of nickel alloy, aluminum alloy, and corroded material.
Pallu	**Aluminum Brass Condenser Tubes.** Shall consist of clean sound condenser tubing which may be plated or unplated, free of nickel alloy and corroded material.
Palms	**Muntz Metal Tubes.** Shall consist of clean sound Muntz metal tubing which may be plated or unplated, free of nickel alloy, aluminum alloy, and corroded material.
Parch	**Manganese Bronze Solids.** Shall have a copper content of not less than 55%, a lead content of not more than 1%, and shall be free of aluminum bronze and silicon bronze.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
Racks	**Scrap Lead—Soft.** Shall consist of clean soft scrap lead, free of all foreign materials such as drosses, battery lead, lead covered cable, hard lead, collapsible tubes, foil, type metals, zinc, iron and brass fittings, dirty chemical lead. Free of radioactive materials.
Radio	**Mixed Hard/Soft Scrap Lead.** Shall consist of clean lead solids, free of foreign materials, such as drosses, battery lead, covered cable, collapsible tubes, type metals, zinc, iron and brass fittings, dirty chemical lead. Free of radioactive materials.
Rails	**Battery Plates.** If cells (plates, separators, and lugs) or battery plates, must be reasonably free of rubber. May be bought and sold by assay or as agreed between buyer and seller.
Rains	**Drained Whole Batteries.** Batteries to be free of liquid and extraneous material content. Aircraft (aluminum or steel cased) and other special batteries subject to special agreement.
Rakes	**Battery Lugs.** Shall be free from battery plates, rubber and foreign material. A minimum of 97% metallic content is required.
Ranks	**Pewter.** Shall consist of tableware and soda-fountain boxes but should contain a minimum of 84% tin. Siphon tops to be accounted for separately. Material must be free of brass, zinc, and other foreign metals.
Ranch	**Block Tin.** Block Tin must assay minimum of 98% tin, and to be free of liquids, solder, and brass connections, pewter, pumps, pot pieces, dirt.
Raves	**High Tin Base Babbitt.** Shall contain a minimum of 78% tin and be free of brassy or zincy metals.
Relay	**Lead Covered Copper Cable.** Free of armored covered cable, and foreign material.
Rents	**Lead Dross.** Should be clean and reasonably free of foreign matter, iron, dirt, harmful chemicals or other metals. Free of radioactive materials. Assay basis, or as agreed between buyer and seller. Other metals present such as antimony, tin, etc. to be accounted for as agreed between buyer and seller.
Ropes	**Lead Weights.** May consist of lead balances with or without iron, as may be specified. Free of foreign materials.
Roses	**Mixed Common Babbitt.** Shall consist of lead base bearing metal containing not less than 8% tin, free from Allens metal, ornamental, antimonial and type metal. Must be free from all zincy and excessive copper in the alloy.
Saves	**Old Zinc Die Cast Scrap.** Shall consist of miscellaneous old zinc base die castings, with or without iron and other foreign attachments. Must be free of borings, turnings, dross pieces, chunks, melted pieces and skimmings. All unmeltables, dirt, foreign attachments, and volatile substances (such as rubber, cork, plastic, grease, etc.) are deductible. Material containing in excess of 30% iron will not constitute good delivery.
Scabs	**New Zinc Die Cast Scrap.** Shall consist of new or unused, clean, zinc base die castings. Castings to be unplated, unpainted, and free from corrosion.
Scope	**New Plated Zinc Die Cast Scrap.** Shall consist of new or unused clean, plated zinc base die castings, free from corrosion.
Scoot	**Zinc Die Cast Automotive Grilles.** Shall consist of clean, old or used zinc base die cast automotive grilles, free from soldered material. All foreign attachments and extraneous materials are deductible.
Score	**Old Scrap Zinc.** Shall consist of clean dry scrap zinc, such as sheets, jar lids, clean unalloyed castings and anti-corrosion plates. Borings and turnings are not acceptable. Material must not be excessively corroded or oxidized. All foreign attachments and extraneous materials are deductible.
Screen	**New Zinc Clippings.** Shall consist of any new pure zinc sheets or stampings free from corrosion. To contain no foreign material or attachments. Printers zinc, such as engravers zinc, lithograph sheets and addressograph plates subject to special arrangements. Printers zinc to be free of routings.
Scull	**Zinc Die Cast Slabs or Pigs.** Shall consist of melted zinc base die cast materials, in smooth clean solid slabs or pigs. Material to be free from drosses and to contain a minimum zinc content of 90%. To contain a maximum of 0.1% nickel and maximum of 1% lead. Blocks are acceptable upon mutual agreement.
Scribe	**Crushed Clean Sorted Fragmentizers Die Cast Scrap, as produced from Automobile Fragmentizers.** To be clean, free of dirt, oil, glass, rubber, and trash. To contain a maximum of 5% unmeltables such as free iron, copper, aluminum and other metals.
Scroll	**Unsorted Zinc Die Cast Scrap.** Produced from automobile fragmentizers. Material to contain about 65% zinc-bearing scrap. Other nonferrous metals such as aluminum, stainless steel, red metal, etc., to be about 40%. Insulated copper wire about 1%. Trash, dirt, glass, rubber, oil, iron not to exceed 5%. Any variations to be sold by special arrangement between buyer and seller.
Scrub	**Hot Dip Galvanizers Slab Zinc Dross (Batch Process).** Shall consist only of galvanizers unsweated zinc dross in slab form from hot dip galvanizing (Batch Process) with a minimum zinc content of 92% and shall be free of skimmings and tramp iron. Broken pieces under 2" in diameter shall not exceed 10% of the weight of each shipment. Slabs shall not weigh over 100 pounds each. Heavier pieces acceptable upon mutual agreement between buyer and seller. Material from continuous galvanizing operation is not acceptable. Blocks are acceptable upon mutual agreement.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
Seal	**Continuous Line Galvanizing Slab Zinc Top Dross.** Shall consist of unsweated zinc dross removed from the top of a continuous line galvanizing bath, in slab form not weighing in excess of 100 pounds each, with a minimum zinc content of 90%. Heavier pieces acceptable upon mutual agreement between buyer and seller. Shall be free of skimmings. Broken pieces under 2" in diameter shall not exceed 10% of the weight of each shipment.
Seam	**Continuous Line Galvanizing Slab Zinc Bottom Dross.** Shall consist of unsweated zinc dross removed from the bottom of a continuous line galvanizing bath, in slab form not weighing in excess of 100 pounds each, with a minimum zinc content of 92%. Heavier pieces acceptable upon mutual agreement between buyer and seller. Shall be free of skimmings. Broken pieces under 2" in diameter shall not exceed 10% of the weight of each shipment.
Shelf	**Prime Zinc Die Cast Dross.** Shall consist of metal skimmed from the top of pot of molten zinc die cast metal. Must be unsweated, unfluxed, shiny, smooth, metallic and free from corrosion or oxidation. Should be poured in molds or in small mounds weighing not over 75 pounds each. Zinc shall be minimum of 85%.
Tablet	**Clean Aluminum Lithographic Sheets.** To consist of alloys 1100 and/or 3003, to be free of paper, plastic, excessively inked sheets and other contaminants. Minimum of three inches in any direction.
Tabloid	**New, Clean Aluminum Lithographic Sheets.** To consist of alloys 1100 and/or 3003, uncoated, unpainted, to be free of paper, plastic, ink, and any other contaminants. Minimum of three inches in any direction.
Taboo	**Mixed Low Copper Aluminum Clippings and Solids.** Shall consist of new, clean, uncoated and unpainted low copper aluminum scrap of two or more alloys and to be free of 7000 series, foil, hair wire, wire screen, dirt, and other foreign substances. Grease and oil not to total more than 1%. Also free from punchings less than ½ in size. New can stock subject to arrangement between buyer and seller.
Taint/Tabor	**Clean Mixed Old Alloy Sheet Aluminum.** Shall consist of clean old alloy aluminum sheet and sheet utensil scrap of two or more alloys, free of 7000 alloy series, foil, venetian blinds, castings, hair wire, screen wire, food or beverage containers, pie plates, hub caps, radiator shells, airplane sheet foil, oil cans, bottle caps, plastic, dirt, and other foreign substances. Oil and grease not to total more than 1%. Up to 10% painted sheet, siding, and awnings permitted. Shall consist of new low copper aluminum can stock and clippings, clean, lithographed or not lithographed, and coated with clear lacquer but free of lids with sealers, iron, dirt and other foreign contamination. Oil not to exceed 1%.
Take	**New Aluminum Can Stock.** Shall consist new low copper aluminum can stock and clippings, clean, lithographed or not lithographed and coated with clear lacquer but free of lids with sealers, iron, dirt and other foreign contamination. Oil not to exceed 1%.
Talap	**Old Can Stock.** Shall consist of clean old aluminum cans, decorated or clear, free of iron, dirt, liquid and/or other foreign contamination.
Talcred	**Shredded Aluminum Used Beverage Can (UBC) Scrap.** Shall have a density of 12 to 17 pounds per cubic foot. Material should contain maximum 5% fines less than 4 mesh (U.S. standard screen size) and no more than 2.5% fines less than 12 mesh (U.S. standard screen size). Must be magnetically separated material and free of steel, lead, bottle caps, plastic cans and other plastics, glass, wood, dirt, grease, trash, and other foreign substances. Any free lead is basis for rejection. Any and all aluminum items, other than used beverage cans, are not acceptable. Items not covered in the specification, including moisture, are subject to special arrangement between buyer and seller.
Taldak	**Densified Aluminum Used Beverage Can (UBC) Scrap.** Shall have a biscuit density of 35 to 45 pounds per cubic foot. Each biscuit not to exceed 60 pounds. Nominal biscuit size range from 10" to 13" x 10¼" to 20" x 6¼" to 9". Shall have banding slots in both directions to facilitate bundle banding. All biscuits comprising a bundle must be of uniform size. Size: Bundle range dimensions acceptable are 41" to 44" x 51" to 54" x 54" to 56" (height). The only acceptable tieing method shall be as follows: Using minimum ⅝" wide by .020 thick steel straps the bundles are to be banded with one vertical band per row and a minimum of two girth (horizontal) bands per bundle. Use of skids and/or support sheets of any material is not acceptable. Must be magnetically separated material and free of steel, lead, bottle caps, plastic cans and other plastic, glass, wood, dirt, grease, trash, and other foreign substances. Any free lead is basis for rejection. Any and all aluminum items, other than used beverage cans, are not acceptable. Items not covered in the specification, including moisture, and any variations in the specification are subject to special arrangement between buyer and seller.
Taldon	**Baled Aluminum Used Beverage Can (UBC) Scrap.** Shall have a minimum density of 14 lbs. per cubic foot, and a maximum density of 17 lbs. per cubic foot for unflattened UBC and 22 lbs. per cubic foot for flattened UBC. Size: minimum 30 cubic feet, with bale range dimensions of 24" to 40" by 30" to 52" by 40" to 84". The only acceptable tieing method shall be as follows: four to six ⅝" x .020" steel bands, or six to ten no. 13 gauge steel wires (aluminum bands or wires are acceptable in equivalent strength and number). Use of skids and/or support sheets of any material are not acceptable. Must be magnetically separated material and free of steel, lead, bottle caps.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
TALDON—*Cont.*	plastic cans and other plastics, glass, wood, dirt, grease, trash and other foreign substances. Any free lead is basis for rejection. Any and all aluminum items, other than used beverage cans, are not acceptable. Items not covered in the specification are subject to special arrangement between buyer and seller.
Taldork	**Briquetted Aluminum Used Beverage Can (UBC) Scrap** Shall have a briquette density of 50 pounds per cubic foot minimum. Nominal briquette size shall range from 12" to 24" x 12" to 24" in uniform profile with a variable length of 8" minimum and 48" maximum. Briquettes shall be bundled or stacked on skids and secured with a minimum of one vertical band per row and a minimum of one girth band per horizontal layer. Briquettes not to overhang pallet. Total package height shall be 48" maximum. Banding shall be at least ⅝" wide by .020" thick steelstrapping or equivalent strength. The weight of any bundle shall not exceed 4,000 pounds. Material must be magnetically separated and free of steel, plastic, glass, dirt and all other foreign subsances. Any and all aluminum items, other than UBC are unacceptable. Any free lead is a basis for rejection. Items not covered in the specification, including moisture, and any variation in the specification are subject to special arrangement between buyer and seller.
Tale	**Painted Siding.** Shall consist of clean, low copper aluminum siding scrap, painted one or two sides, free of iron, dirt, corrosion, fiber backing or other types of foreign contamination.
Talent	**Coated Scrap.** Shall consist of awnings, venetian blinds, vinyl, plastic, etc. Shall be subject to special arrangements between buyers and sellers.
Talk	**Aluminum Copper Radiators.** Shall consist of clean aluminum and copper radiators, and/or aluminum fins on copper tubing, free of brass tubing, iron and other foreign contamination.
Tall	**E.C. Aluminum Nodules.** Shall consist of clean E.C. aluminum, chopped or shredded, free of screening, hair-wire, iron, insulation, copper and other foreign contamination. Must be free of minus 20 mesh material. Must contain 99.45% aluminum content.
Talon	**New Pure Aluminum Wire and Cable.** Shall consist of new, clean, unalloyed aluminum wire or cable free from hair wire, wire screen, iron, insulation and any other foreign substance.
Tann	**New Mixed Aluminum Wire and Cable.** Shall consist of new, clean unalloyed aluminum wire or cable which may contain up to 10% 6000 series wire and cable free from hair wire, wire screen, iron, insulation and any other foreign substance.
Taste	**Old Pure Aluminum Wire and Cable.** Shall consist of old, unalloyed aluminum wire and cable containing not over 1% free oxide or dirt and free from hair wire, wire screen, iron, insulation and any other foreign substance.
Tassel	**Old Mixed Aluminum Wire and Cable.** Shall consist of old, unalloyed aluminum wire and cable which may contain up to 10% 6000 series wire and cable with not over 1% free oxide or dirt and free from hair wire, wire screen, iron, insulation and any other foreign substance.
Tarry	**Aluminum Pistons.** (a) Clean Aluminum Pistons. Shall consist of clean aluminum pistons to be free from struts, bushings, shafts, iron rings and any other foreign materials. Oil and grease not to exceed 2%. (b) Aluminum Pistons with Struts. Shall consist of clean whole aluminum pistons with struts to be free from bushings, shafts, iron rings and any other foreign materials. Oil and grease not to exceed 2%. (c) Irony Aluminum Pistons. Should be sold on recovery basis, or by special arrangements with purchaser.
Teens	**Segregated Aluminum Borings and Turnings.** Shall consist of clean, uncorroded aluminum borings and turnings of one specified alloy only and subject to deductions for fines in excess of 3% through a 20 mesh screen and dirt, free iron, oil, moisture and all other foreign materials. Material containing iron in excess of 10% and/or free magnesium or stainless steel or containing highly flammable cutting compounds will not constitute good delivery.
Telic	**Mixed Aluminum Borings and Turnings.** Shall consist of clean, uncorroded aluminum borings and turnings of two or more alloys and subject to deductions for fines in excess of 3% through a 20 mesh screen and dirt, free iron, oil, moisture and all other foreign materials. Material containing iron in excess of 10% and/or free magnesium or stainless steel or containing highly flammable cutting compounds will not constitute good delivery. To avoid dispute should be sold on basis of definite maximum zinc, tin and magnesium content.
Tense	**Mixed Aluminum Castings.** Shall consist of all clean aluminum castings which may contain auto and airplane castings but no ingots, and to be free of iron, dirt, brass, babbitt and any other foreign materials. Oil and grease not to total more than 2%.
Tepid	**Wrecked Airplane Sheet Aluminum.** Should be sold on recovery basis or by special arrangements with purchaser.
Terse	**New Aluminum Foil.** Shall consist of clean, new, pure, uncoated, unalloyed aluminum foil, free from anodized foil, radar foil and chaff, paper, plastics, or any other foreign materials. Hydraulically briquetted material by arrangement only.
Testy	**Old Aluminum Foil.** Shall consist of clean, old, pure, uncoated, unalloyed aluminum foil, free from anodized foil, radar foil and chaff, paper, plastics, or any other foreign materials. Hydraulically briquetted material by arrangement only.

US non-ferrous scrap specifications (continued)

ISRI Code Word	Item
Thigh	**Aluminum Grindings.** Should be sold on recovery basis or by special arrangements with purchaser.
Thirl	**Aluminum Drosses, Spatters, Spillings, Skimmings and Sweepings.** Should be sold on recovery basis or by special arrangements with purchaser.
Throb	**Sweated Aluminum.** Shall consist of aluminum scrap which has been sweated or melted into a form or shape such as an ingot, pig or slab for convenience in shipping; to be free from corrosion, drosses or any foreign materials. Should be sold subject to sample or analysis.
Tooth	**Segregated New Aluminum Alloy Clippings and Solids.** Shall consist of new, clean, uncoated and unpainted aluminum scrap of one specified aluminum alloy only and to be free of foil, hair, wire, wire screen, dirt, and other foreign substances. Oil and grease not to total more than 1%. Also free from punchings less than ½" in size. New can stock subject to arrangement between buyer and seller.
Tough	**Mixed New Aluminum Alloy Clippings and Solids.** Shall consist of new, clean, uncoated and unpainted aluminum scrap of two or more alloys free of 7000 series and to be free of foil, hair wire, wire screen, dirt, and other foreign substances. Oil and grease not to total more than 1%. Also free from punchings less than ½" in size. New can stock subject to arrangement between buyer and seller.
Tread	**Segregated New Aluminum Castings, Forgings and Extrusions.** Shall consist of new, clean, uncoated aluminum castings, forgings, and extrustions of one specified alloy only and to be free from sawings, stainless steel, zinc, iron, dirt, oil, grease and other foreign substances.
Trump	**Aluminum Auto Castings.** Shall consist of all clean automobile aluminum castings of sufficient size to be readily identified and to be free from iron, dirt, brass, babbitt bushings, brass bushings, and any other foreign materials. Oil and grease not to total more than 2%.
Twang	**Insulated Aluminum Wire Scrap.** Shall consist of aluminum wire scrap with various types of insulation. To be sold on a sample or recovery basis, subject to agreement between buyer and seller.
Twist	**Aluminum Airplane Castings.** Shall consist of clean aluminum castings from airplanes and to be free from iron, dirt, brass, babbitt bushings, brass bushings, and any other foreign materials. Oil and grease not to total more than 2%.
Twitch	**Fragmentizer Aluminum Scrap (from Automobile Shredders).** The material, as received, must be dry and not to contain more than 3% maximum free zinc, 1% maximum free magnesium, and 1.5% maximum free iron and stainless. Not to contain more than a total 5% maximum of non-metallics, of which no more than 1% shall be rubber and plastics. To be free of excessively oxidized material. Any variations to be sold by special arrangement between buyer and seller.
Wafer	**Magnesium Clips.** Shall consist of clean magnesium clips in crucible size, free of copper, aluminum, and zinc flashings and excessive oil and grease. To be free of all foreign attachments.
Walnut	**Magnesium Scrap.** Shall consist of magnesium castings, magnesium engine blocks and transmission casings, bomber and car wheels, extrusions, and sheet. Material to be free from brass and copper inserts and all foreign attachments. To be free of anodes, hollow castings and explosives. Percentages of and penalties for dirt, oil, grease, and iron to be subject to agreement between buyer and seller. Excessively large pieces to be negotiated between buyer and seller.
Wine	**Magnesium Engraver Plates.** To be free of copper, aluminum, zinc, and electrotype plates. To be clean and free of all foreign attachments. Magnesium plates shipped loose by agreement between buyer and seller.
Wood	**Magnesium Dockboards.** Shall consist of clean magnesium dockboard cut or broken to size agreed upon by buyer and seller. To be free of all foreign attachments.
World	**Magnesium Turnings.** It is recommended that these materials be sold by special arrangement between buyer and seller.
Aroma	**New Nickel Scrap.** Shall consist of clean new sheet, plate, bar, tube, and any other wrought nickel scrap solids. Nickel minimum 99%; Cobalt maximum 0.25%; Copper maximum 0.50%. Free of castings, as well as any foreign attachments or other contamination.
Burly	**Old Nickel Scrap.** Shall consist of old and/or new sheet, plate, bar, tube, and any other wrought nickel scrap solids. Material to contain a minimum of 98% nickel; Copper maximum 0.50%. This grade to be free of castings, soldered, brazed, sweated, or painted material, other metallic coating, foreign attachments, and any other contamination.
Dandy	**New Cupro Nickel Clips and Solids.** Shall consist of clean, new, segregated (normally accepted analysis grades) either 70/30, 80/20, or 90/10 cupro nickel tube, pipe, sheet, plate, or other wrought solid forms. Must be free of foreign attachments or any other contamination.
Daunt	**Cupro Nickel Solids.** Shall consist of old, and/or new, segregated (normally accepted analysis grades) either 70/30, 80/20, 90/10 cupro nickel tube, pipe, sheet, plate, or other wrought solid forms. Maximum 2% sediment allowable. Any other forms of cupro nickel solids such as castings, gates, risers, spills, etc., packaged separately, may or may not be included, only upon agreement