

TERNE COATED STEEL

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Terne coated steel sheets have until recently been one of the least publicized steel mill products. The American Iron and Steel Institute, which publishes wonderfully detailed reports on industry shipments of steel mill products, does not classify terne sheets as a separate product in its currently published reports. A portion of this market which has totalled over 250,000 tons in peak years is included with tin mill product shipments while part is included under the title "Sheets - All Other Coated" which covers a variety of special coated steel sheets.

The size of the market and its growth potential has not been lost to the individual steel producer, however. In early 1962, U. S. Steel announced plans to almost double its terne coat capacity while one of our competitors - late in the same year - began production with a new line.

While terne coated steel represents only three-tenths of one per cent of total steel production and lead for terne metal is only one or two-tenths of one per cent of total lead consumption in the United States, the growth possibilities in markets for terne coated sheets are significant.

The history of the development of terne coated steel closely parallels that of tin plate. The steel for both products, in fact, was first rolled in the early 18th Century in South Wales - doubtless on the same mills.

The common ancestry of the two products is evidenced by the early designation of terne sheet - which was used principally as a roofing material - as "roofer's tin".

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Actually, lead rather than tin is the primary component of the coating material - representing 80% to 85% of the alloy. The tin - which comprises only 15% to 20% of the coating - is included to assure a smooth, continuous coating ofterne metal on the carbon steel base. Lead, alone, does not alloy with iron and, therefore, the tin acts as a bonding material between the steel base and the coating.

Theterne coating - which provides a relatively inexpensive, tough, corrosion-resistant coating for the steel is applied by immersing the steel in a hot bath of theterne mixture.

The resulting product has a flat or lustreless appearance. This contrast with the bright tin coating probably suggested the name "terne" which means "dull" or "tarnished" in French.

Terne plate did not enjoy the tremendous growth which characterized the market for tin plate. The lead coating was toxic and, therefore, could not be used for food packaging. Its first major application was as a less expensive replacement for lead in flashing, weather sealing, gutters and roofing. It followed, therefore, the traditional use of lead sheets recognized even in the time of the Greeks when downspouts were fabricated of lead. During the Middle Ages, lead sheets produced by pouring molten lead on inclined beds of sand were used for roofs for monumental structures such as Chartres Cathedral and Old St. Paul's Cathedral in London.

Dignified by its association with the lead roofs of antiquity,terne sheets were used on many important buildings constructed in Europe and the United States in the 18th and 19th Centuries, including Thomas Jefferson's

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Monticello and the Octagon House in Washington, which now houses the American Institute of Architects.

The older lead roofs were customarily left unpainted, and time enriched the surface by imparting a rich patina which resulted from impurities such as silver in the lead. Terne plate, however, must be periodically painted because both lead and tin are cathodic to iron so that terne metal will increase the corrosive action on the steel base if it becomes exposed. On this point, therefore, terne sheet is less desirable than galvanized sheet in many applications because the zinc coating will cathodically protect the steel base at cut edges, scratches, or other coating discontinuities under normal atmospheric conditions.

Terne plate, even though it has a smooth surface which feels almost "greasy" to the touch, exhibits satisfactory adhesion to the conventional paint systems. The modern preference for colorful roofs and the recognition that a white roof permits better control of interior temperatures has resulted in renewed interest in this product for roofing applications.

In spite of this renewed popularity, however, architectural applications represent only a minor use of terne coated steel at present. Short terne use for paint cans and long terne use by the automotive industry represent two larger markets.

Short ternes are recognized as a tin mill product as were the first terne sheets made in Wales. This product is used principally for cans for paints, paint thinners, and lacquers and, therefore, is produced in light gauges - 29 gauge and lighter. The terne coating is applied to the basic sheet product -

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black plate - which is a scale-free mild steel. Short ternes comprise a relatively minor portion of total tin mill product, and production averages approximately 20,000 to 25,000 tons per year. Customarily produced in relatively small, cut-to-length sheets, its use for roofing sheets has declined in favor of long ternes, which are produced in sheets up to 144 inches in length as well as coils and in widths limited only by the equipment on which it is produced.

Long ternes represent a considerably larger market, which has averaged between 150,000 and 170,000 tons in recent years. Long ternes are considered as a sheet product, and most of the market growth as well as most of the recent facility expansion has occurred in this sector of the market for ternes coated steel.

The rest of my talk will concentrate on a discussion of Long Ternes Sheets.

What exactly is a Long Ternes Sheet? At U. S. Steel's Gary Sheet & Tin Mill, we start with a conventional low carbon open hearth steel prepared as a slab and initially hot reduced on our 80" hot strip mill. The material exits from this unit in coil form. Following pickling to remove the mill scale, the material is then cold reduced to ordered thickness with extremely close attention paid to uniformity and accuracy of gage and width. The product is then box annealed to impart softness and ductility. It is then coated on a continuous hot dip ternes line to the ordered coating weight specification. We can provide material in either coils or cut length form as thick as .0635" and as thin as .0172" in widths from 6" to 48". Coils can be supplied in weights up to about 50,000 pounds. The product is customarily supplied in a

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variety of coating weights ranging from a minimum of about one-fourth ounce per square foot to about a half ounce per square foot.

Approximately 70% to 75% of long term production is consumed by the automotive industry for gasoline tanks and oil and gas filters. Gas tanks are by far the biggest item.

Long term sheet is admirably suited for the manufacture of gas tanks because of its high degree of corrosion resistance. The term coating is extremely ductile and, therefore, the danger of chips of the coating or oxidized steel passing out of the tank to clog the fuel lines is almost nonexistent.

Fuel tanks are usually designed with bumps and hollows to fit the restricted space available under today's low-slung cars. The excellent drawing qualities of steel are necessary for this complex stamping operation. Incidentally, the term coating acts as a good lubricant in drawing and stamping operations.

Tanks are usually made in two pieces which are joined, crimped, and seam welded to form the unit. Filler pipes and fuel lines are also soldered to the tanks. Long terms can be readily soldered with noncorrosive fluxes.

In spite of the many virtues of long terms for this use, one can only be realistic by recognizing the potential effect of competitive materials on this market. During World War II and the Korean War, auto manufacturers experimented with many substitutes in order to conserve the scarce materials used in the production of term sheets. These included uncoated sheets,

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painted and asphalt coated sheets, and eventerne plate with lower amounts of tin. But no other material has approached the functional capabilities and low cost of material and fabrication of ternes sheets.

One of the principal barriers to competitive materials - outside of purely cost considerations - is the extraordinary impact resistance of long ternes when fabricated into a gasoline tank. Its position in most cars makes it particularly subject to damage from flying stones or as the result of rear-end collisions. When the steel tank is subject to the force of impact, it may dent but seldom ruptures and, therefore, the seams and pipe connections remain tight. Other metals as well as reinforced or unreinforced plastic cannot give the assurance against puncturing and leak-free seams, which are such an important safety consideration when an inflammable fluid is involved.

The automotive market assures high volume and growth for the market for long ternes. The record year for long ternes production was 1955, when 217,000 tons were produced. That, incidentally, was the record year for automobile and truck production when almost 9.2 million units were produced including over 7.9 million automobiles. Since then - with the exception of 1958 when total automobile and truck production plummeted to 5.1 million units - production has ranged between 150,000 and 170,000 tons. In the last few years, the automotive market has had a good tone, and there is increased confidence in the long range growth potential of the industry. With continued growth based on projected increases in population and per capita income, the portion of the long ternes market committed to the automotive market is extremely bright.

The potential for increased production of long ternes does not rest entirely with the automobile industry. Most other gasoline engines have long ternes tanks -- light tractors, lawn mowers, outboard motors, gasoline powered saws, and so on. With the growth of do-it-yourself activities and suburban living, there has been a considerable increase in these areas.

Long ternes are also finding increasing use in TV and radio chassis where it is replacing steel sheets coated with cadmium. As chassis material, it offers high electrical conductivity as well as excellent solderability.

A few additional uses may be mentioned -- long ternes are frequently used in the fabrication of fire doors and frames where the excellent paint adherence of the ternes coating as well as its corrosion resistance is important. These same characteristics favor its use in the manufacture of burial caskets.

At this point you may be wondering about the amount of lead consumed in ternes coated product. This, of course, varies over a wide range depending upon specification and product mix requirements. At U. S. Steel, our experience indicates that a good over-all average figure to use would be approximately 25 pounds of lead consumed for each ton of Long Ternes Sheets produced. On the basis of estimated 1962 industry shipments of 160,000 tons of Long Ternes Sheets, this works out to about 2,000 tons of lead consumed in this steel product. Adding Short Ternes to this figure would raise the total 1962 lead consumption for ternes coated steels to approximately 2,400 tons.

Although this tonnage is a relatively small portion of your industry's lead shipment, we, at U. S. Steel, believe the future for Long Term Sheet product is bright.

In expectation of future growth in the market, U. S. Steel announced in May, 1962, that it would build a new continuous long term line at Irvin Works - close to Pittsburgh, Pennsylvania. The new line is expected to go into operation in late 1963 and will double U. S. Steel's producing capacity.

The new line will produce long term sheets in widths greater than any now available in the industry and will produce product at faster speeds than any other term line in existence.

U. S. Steel's production up 'til now has been concentrated at Gary, Indiana. The new facility is located where it not only can supply the automotive market but also can serve the eastern states and the export market. It is expected that a major portion of production will be shipped in coil form, which is being increasingly demanded by automotive customers who are geared to volume production.

With the new capacity added recently, the range of widths and coil sizes available to consumers has expanded greatly. The growth in demand for galvanized and aluminum coated steel sheets in recent years as well as the acceptance of pre-painted sheets demonstrates consumer acceptance of coated steel products. The unique physical characteristics of term coated sheets promise expanded market opportunities in the future.

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