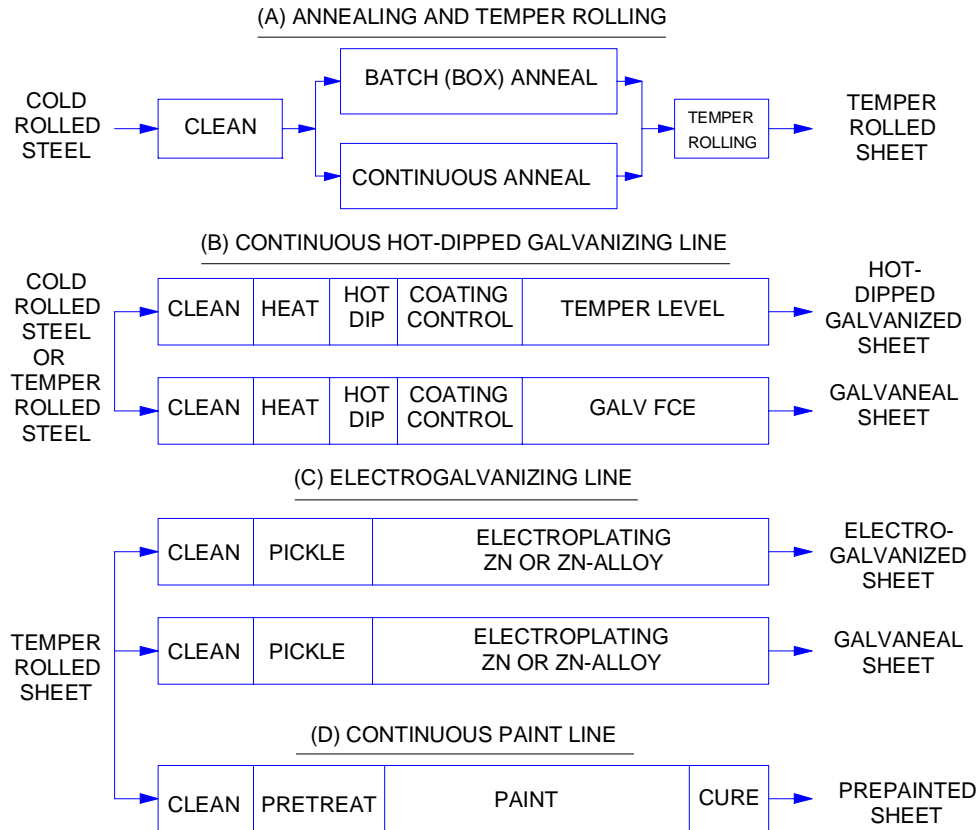


## 2.8 COATED STEEL SHEETS

The need in the automotive industry to improve corrosion resistance has brought about an increased use of metallic coated steel sheets in place of the cold rolled (uncoated) sheets formerly used. Metallic coated includes hot dipped galvanized and electrolytically coated sheets. Preprimed and prepainted sheets are also available, and can be obtained either with or without the metallic coating on the underlying steel substrate. Block diagrams for typical finishing and coating flowlines are show in [Figure 2.8-1](#).



**Figure 2.8-1** Typical finishing and coating flowlines

### 2.8.1 HOT DIPPED METALLIC COATED SHEETS

Hot dipped coating lines are used to produce galvanized coatings, galvanealed coatings, aluminum coatings, aluminum-zinc alloy coatings, and terne (alloys of 12% to 25% tin, balance lead) coatings. Terne alloys are environmentally unacceptable to the automotive industry. The galvanized products are in greatest demand for automotive applications. Variations include two side coated, differentially coated, and one side coated products in a variety of coating masses (thicknesses), finishes, and zinc-iron alloy combinations. Process temperatures differ significantly for the various coatings, and the higher temperatures encountered in some operations can significantly alter the mechanical properties for these materials compared with cold rolled or electrogalvanized sheet. Advanced steel making and processing techniques have been developed to minimize these differences in mechanical properties.

### 2.8.2 ELECTROLYTIC METALLIC COATED SHEETS

Electrolytic coated sheets are mainly used for body panels, trim, and hardware applications. The electrolytic coating process does not significantly alter the mechanical properties of the cold rolled sheet; it has the least effect of any of the normally used coating processes on the mechanical properties of the steel sheet.

### 2.8.3 PREPRIMED STEELS

Improved methods of handling and processing sheet steel have generated interest in the use of preprimed and prepainted steels. The use of two-sided preprimed steel has been investigated for the purpose of eliminating in-plant priming operations. A trial run of front fenders was performed to determine the feasibility of fabrication, and a body assembly plant was studied to determine the effects on manufacturing operations. The potential advantages include reductions in:

1. Floor space
2. Capital equipment
3. Preparation for paint
4. Labor cost

The potential disadvantages include problems with:

1. Stamping scrap mix
2. Contamination of scrap
3. Corrosion resistance at cut edges
4. Spot welding

In the trial stamping run, the coating withstood the bending and stretching associated with the forming operations with no loss of integrity. It was therefore concluded that body panels can be formed from preprimed sheet in existing metal forming presses using existing dies. Some material handling equipment will require modification to prevent damage to the coating. Shipping costs will be increased somewhat because it will be necessary to separate the stampings to prevent damage to the coating, and the number of stampings per truck load will be reduced. The cost increase will depend to a great extent on the shipping distance.

The body assembly plant study indicated that the preprimed panels can be processed through the assembly plant with only minor alterations in some material handling operations. Some assembly operations must also be revised. Preprimed steel is not compatible with welding, but appears to be fully compatible with fastening operations utilizing mechanical fasteners, deformation of the parent metal, and adhesive bonding.

### 2.8.4 PREPAINTED STEELS

A similar trial run of hood outer panels was performed using fully topcoated prepainted steel. Various topcoat colors matching those of the assembly plant paint shop and specially formulated to withstand the metal forming operations were applied to the steel surface via the conventional paint lines. Potential advantages and disadvantages were categorically the same as for preprimed steel, but greater in magnitude.

The coatings withstood the forming operations with no loss of integrity. It was therefore concluded that body panels of similar configuration can be formed from fully topcoated prepainted sheet in existing metal forming presses using existing dies. Other conclusions, regarding processing, shipping, and assembly operations, were essentially the same as for preprimed steel. Paint suppliers have expressed confidence that they can supply paint formulations to meet in-plant color requirements when market demand justifies the effort.

### **2.8.5 EFFECTS ON FORMABILITY**

Two related material factors influence the formability of coated sheets: the substrate and the coating. The characteristics of the coating, although less important to the forming process than those of the substrate, can have significant effects on the forming process because they can affect metal flow over tool and die surfaces.

The following guidelines can be helpful in designing parts using coated steel sheet.

1. The formability of most hot dipped galvanized and galvanneal sheet grades is slightly lower than the same steel produced in the uncoated condition.
2. Relative to other hot dipped galvanized sheets, ultra low carbon stabilized steel sheets exhibit very good substrate properties after hot dipped galvanizing.
3. The electrogalvanizing process does not significantly affect the mechanical properties of the substrate.
4. Direct contact with steel suppliers in the application of galvanized steels to forming is recommended because of the diversity of galvanized steels and the knowledge each supplier has about his own products.
5. Difficulty with forming coated sheets can be minimized by designing parts with lower forming severity.
6. Where possible, larger die radii are preferred for the forming of galvanized sheet.
7. Where possible, stretch forming is preferred to draw forming for galvanized sheet.
8. Simple substitution of electrogalvanized sheet for uncoated sheet may require changes in binder pressure.
9. Careful selection of lubricants is particularly important for galvanized steel sheets, and previous experience with uncoated sheet may not be applicable.

### **BIBLIOGRAPHY FOR SECTION 2.8**

Refer to [Section 2.14](#) for a comprehensive bibliography for [Section 2.1](#) to [2.13](#).

