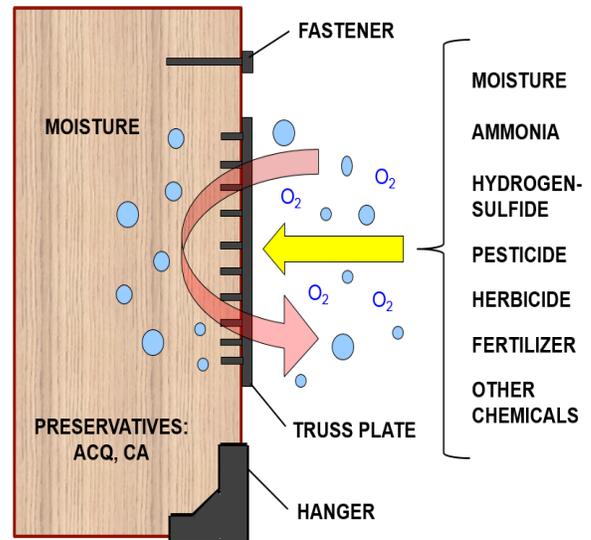


Introduction:

According to the National Building Code of Canada, Farm building means a building or part thereof that does not contain a residential occupancy and that is associated with and located on land devoted to the practice of farming, and used essentially for the housing of equipment or livestock, or the production, storage or processing of agricultural and horticultural produce or feeds.

Due to the occupancy requirements of farm buildings, the environment of structural components will likely have corrosive agents such as excessive moisture generated by animals, organic gases such as ammonia and hydrogen sulfide from animal waste, and agricultural chemicals such as fertilizers, herbicides and pesticides. Structural components in the roof or walls of farm buildings often contain metal connectors, such as truss plates, joist hangers, and fasteners such as nails and screws. These components naturally corrode over time due to a process known as electrochemical oxidation, or rusting. However, the rate of corrosion will accelerate, sometimes dramatically, with prolonged exposure to the corrosive agents.

The effect of corrosion can range from unpleasant cosmetic coloration of equipment to complete deterioration of connectors, causing a total structural failure and possibly endangering human or animal life. This guideline is prepared, specifically for farm buildings, to serve as a reference document for mitigating corrosion effects in light metal plate connected wood trusses.



The figure above shows the interaction between the metal connectors and various corrosive agents in a corrosion-susceptible farm building. The corrosive agents may be present in both the wood and air environments.

Corrosion Protection:

Metal connector products are typically protected by galvanizing the metal with G90 zinc coating in Canada (G60 in USA). That is often sufficient in many standard applications, but may be inadequate in corrosion-susceptible buildings. The following methods and products are known to provide the connectors with extra protection against corrosion and may extend their serviceable life:

1. Vapour Barrier and Separate Ventilation:

- Install a vapour barrier, such as 4-6 mil polyethylene, to completely cover the truss assembly; all seams are taped and all gaps are covered to prevent the corrosive agents from entering the attic space.
- Ventilate the interior and attic spaces separately. The ventilation system should supply plenty of fresh air to move moisture and corrosive gasses away from the interior space; the exhaust ducts should be located far away from the attic's ventilation openings.
- Typically, insulation is also required inside the attic space to prevent condensation.

2. Inspection: Periodic inspection is advised to look for leakage through the vapour barrier and corrosion on the connectors. Once corrosion is detected, take the appropriate steps to remove the corrosive agents from the attic space or provide additional protection for the connectors.

3. Corrosion-Resistant Products:

- MiTek G185 truss plates. G185 has twice the amount of zinc as G90 to provide extra protection.
- MiTek stainless steel truss plates. Stainless steel is more corrosion resistant than any other products.
- USP G185, hot dip galvanized (HDG), or Gold Coat (GC) hangers and fasteners.
- Allow 3 to 4 weeks lead time prior to truss fabrication date for G185 and stainless steel truss plates. Note that G185/stainless plates are only available in 20 gauge and limited sizes.

4. Duplex System:

This implies the application of two corrosion protection systems (zinc + paint), which has been found to provide protection superior to either system due to the synergy between them. The key to a successful duplex system is to carefully prepare the galvanized surface before painting or powder coating.

- Remove dirt, debris, and chromate (if any) from the connectors. Do not use any surface preparation method that can damage the connectors or lumber.
- Apply paint over the zinc coating. Use TPIC-approved paints, such as those conforming to the SSPC Paint-16 standard. G90 Duplex = G90 connector + paint. G185 Duplex = G185 connector + paint.
- As per TPIC's recommendation, all coatings shall be brush-applied to the embedded truss plates during or after truss installation. (See Appendix I of TPIC 2014 for more details).
- If the plates are pre-coated with paint before plate embedment, modification factors may need to be applied. Consult the manufacturer of these pre-coated plates for details.

5. Use Combination:

In some truss designs, G185/stainless plates may not be strong enough to handle the high stress joints. One solution is to use a G90 duplex system consisting of higher strength material (grade 60 or better and/or 18 gauge or thicker). This is especially an effective solution for longer span trusses, which often require high strength plates at the heel and splice joints.

Design Guideline:

The guideline presented below is based on specific building environment. When in doubt, use a higher level of protection than anticipated or seek professional consultation. Where this guideline differs from the requirements of the Authority Having Jurisdiction (AHJ), the requirements of the AHJ shall govern.

Building Environment	Design Guideline (see Notes 1, 2, 3, 4)
<p>Low Corrosion Level:</p> <ul style="list-style-type: none"> • Grain/hay/equipment storage. • Low exposure to moisture, organic gases, and chemicals. 	<ul style="list-style-type: none"> • Provide ventilation. • G90 connectors.
<p>Medium Corrosion Level:</p> <ul style="list-style-type: none"> • All other environments that are not low or high corrosion level. 	<p>Option 1:</p> <ul style="list-style-type: none"> • G90 connectors + Vapour barrier + Separate ventilation <p>Option 2:</p> <ul style="list-style-type: none"> • G90 Duplex or G185 connectors + Ventilation • Apply applicable strength modification factors (see Note 5)
<p>High Corrosion Level:</p> <ul style="list-style-type: none"> • High exposure to moisture, organic gases, and chemicals. • Storage of manure and/or silage. • Housing of swine, poultry and cattle. 	<p>Option 1:</p> <ul style="list-style-type: none"> • G90 Duplex or G185 connectors + Vapour barrier + Separate ventilation (see Note 6) <p>Option 2:</p> <ul style="list-style-type: none"> • Stainless steel or G185 Duplex connectors • Apply applicable strength modification factors (see Note 5)

DESIGN GUIDELINE NOTES:

Note 1: Periodic inspection is recommended for all farm building environments. Annual inspection frequency is recommended at minimum.

Note 2: When using wood preservatives (such as ACQ and CA) that are known to exacerbate corrosion in metal connectors, a minimum of G185 or better protection is required. Additionally, plate strength is required to be modified by a factor of 0.8 in both grip and metal. Note that G90 Duplex is not recommended for truss plate protection if the paint is applied after plate embedment. When using fire retardants or other strength-reducing chemicals, manufacturer specific modification factors are required for lumber and connectors.

Note 3: Whenever trusses are exposed to wet service condition, modification factors are required for the lumber and connectors as per code. Wet service condition occurs when the average equilibrium moisture content of solid wood over a year is more than 15% and may exceed 19% at any time. The moisture level in the wood can be measured using a moisture meter.

Note 4: Galvanic corrosion occurs when there is physical contact between dissimilar metals. This has the net effect of accelerating the rusting process. Galvanic corrosion can be minimized by ensuring that all connectors that are in contact with each other are made from the same material composition. For example, use stainless steel nails with stainless steel hangers and galvanized nails with galvanized hangers. Gold Coat connectors may be used with Gold Coat or HDG fasteners.

Note 5: For instructions on how to apply strength modification factors in the MiTek Engineering software, refer to Software Technical Advisory "TA016 - How to Apply Strength Modification Factors".

Note 6: Considering the intended use and operation of the building, the project engineer/building designer may do a risk assessment to determine the overall effectiveness of all corrosion protection methods and products. G90 connectors may be used in place of G90 Duplex or G185 if the risk assessment finds that:

- a) there is a low probability of the corrosive agents entering the attic space,
- b) any corrosive agent that passes the vapour barrier will not cause rapid corrosion and structural failure,
- c) periodic inspection will be carried out to detect the onset of corrosion, and
- d) any corrosion problem will be rectified in a timely manner to prevent further degradation.

DISCLAIMER:

The information provided in this guideline shall not be used as a substitute for competent professional examination and verification. It is the responsibility of the building designer/engineer to determine the applicability and suitability of the information provided. Anyone making use of this information assumes all responsibility and liability arising from such use.