TrusSteel Floor Trusses – Design Criteria

Purpose of this Bulletin

There is a special set of design criteria for TrusSteel floor trusses. Please observe this set of criteria whenever you design a TrusSteel floor truss. These are minimum design criteria, the structural specifications may call for more stringent criteria.

Information

Floor truss designs must meet all of the criteria listed below in order to be eligible to receive a seal from TrusSteel professional engineers:

1. Overall truss span-to-depth ratio shall not exceed 24.
2. Live Load deflection limited to L/360 and Total Load deflection limited to L/240.
3. For web to chord connections, double shear fasteners are recommended. Single shear screws are allowed, however a minimum of two screws on each face at each joint are required.
4. Top chords must be 20 GA minimum unless deck fasteners are available for 22 GA applications.
5. If no rigid ceiling is directly attached, the bottom chords must be braced at 8 ft o.c. max for small chord and 10 ft o.c. max for large chord.
6. All floor trusses must have strongbacks at 10 ft. o.c. max. with strongback positioned at a vertical. Refer to TrusSteel Standard Detail TS066.
7. Chases and/or untriangulated areas are allowed but must be checked with an unbalanced live load of 0.0/1.0 about the opening(s).
8. Floor trusses that are cantilevered or have interior bearings should be checked with an unbalanced live load of 0.0/1.0 about the bearing(s).
9. Any additional framing loads that occur over the top chords of the truss from other framing (such as walls with trusses framing into them) must be applied to the top chord of the floor truss at the time the truss is engineered. If these additional framing loads are supported by framing other than the floor truss (i.e. squash blocks), no additional loads need be applied to the top chord of the floor truss.
10. Some building codes may require a moveable load check depending on building use.
11. Top chord bearing trusses are allowed, but special design and detailing criteria have to be met. Refer to TrusSteel Standard Detail TS020.

Application

You will need to identify and input these design variables into the SteelVIEW® software so that the program will enforce this set of design criteria. Deflection criteria, fastener type, minimum screws per joint, minimum chord gauge, and chord bracing (i.e. purlins) can be preset in Job/Global Settings. Framing loads, top chord bearing conditions, unbalanced live loads and movable loads involve manual input.

Referenced Documents

TS020
TS066

Revisions

- General revisions on 1/10/02.
- This bulletin was revised on 9/21/10

Long Span CFS Trusses

Purpose of this Bulletin

Long span cold-formed steel (CFS) trusses create special challenges for the fabricator, contractor and erection crew. The purpose of this Bulletin is to define what is considered a long span truss and to inform the TrusSteel fabricator as to the special requirements for manufacturing, handling, installing, restraining and bracing of a long span truss.

Definition

A long span truss is any truss with a span equal to or greater than 60 ft.

Application

The truss manufacturing recommendations listed below are strongly encouraged for any truss over 80 ft. For trusses over 90 ft., the TrusSteel fabricator shall fill out the attached form (pg. 3) and return it to their TrusSteel engineer before approved truss drawings can be issued. TrusSteel recommends that the truss manufacturer keep a completed copy of this form for their records.

Important Criteria for Long Span Trusses

INSTALLATION RESTRAINT/BRACING:

- Refer to CFSBCSI, "Cold-Formed Steel Building Components Safety Information," for a guide to good practice for handling, installing, restraining and bracing of Cold-Formed Steel trusses. This guide is published by CFSC (Cold Formed Steel Council), 6300 Enterprise Lane, Madison, WI 53719.
- The erection contractor should have experience in installing long span CFS trusses.
- Per IBC2012 Section 1705.2.2.2, for trusses spanning 60 ft. or greater, an inspection is required to verify that the temporary restraint/bracing is installed in accordance with the *approved* truss submittal package.
- Per IBC2012 Section 2211.3.3, for trusses spanning 60 ft. or greater, the owner shall contract with a Registered Design Professional for the design of the temporary installation restraint/bracing.

PERMANENT RESTRAINT/BRACING:

- Refer to Cold Formed Steel Engineers Institute (CFSEI) Technical Note 551e for permanent bracing design guidelines.
- The Building Designer is responsible for specifying the method of the permanent individual truss member restraint/bracing per AISI S214-07/S2-08.
- Per IBC2012 Section 1705.2.2.2, for trusses spanning 60 ft. or greater, an inspection is required to verify that the permanent restraint/bracing is installed in accordance with the *approved* truss submittal package.
- Per IBC2012 Section 2211.3.3, for trusses spanning 60 ft. or greater, the owner shall contract with a Registered Design Professional for the design of the permanent individual truss member restraint/bracing.

Truss Manufacturing Criteria and Recommendations

Truss up to an 80 ft. span:

- Trusses to be manufactured in accordance with the approved truss design drawings.

Truss over 80 ft. span:

- Trusses to be manufactured in accordance with the approved truss design drawings with the following minimum standards, as applicable.
- A minimum of 2 double shear fasteners or 4 single shear screws (2 to each face) **must** be used at every joint for each single ply truss.
- 33TSC4.00 or higher gauge material is recommended for top and bottom chords.
- Take care during the entire handling and erection process that trusses are not subjected to out-of-plane bending.

Included Documents

Attached form

Referenced Documents

- ANSI/AISI/COFS/S214-07/S2-08 – North American Standard for Cold-Formed Steel framing – Truss Design, 2007 edition including the 2008 supplement.
- CFSBCSI - Cold-Formed Steel Building Components Safety Information, Cold-Formed Steel Council (CFSC), 2008 edition.
- IBC2012 – International Building Code, International Code Council, 2012.
- Technical Note 551e – Design Guide for Permanent Bracing of Cold-Formed Steel Trusses, Cold-Formed Steel Engineer's Institute (CFSEI), February 1998.

Revisions

- This bulletin was revised on 02/13/13
- This bulletin was revised on 02/05/13
- This bulletin was revised on 7/21/10

Long Span Truss Reporting Form - Trusses over 90 ft. Length

Long span cold-formed steel (CFS) trusses create special challenges for the fabricator, contractor and erection crew. Please fill out this form (use additional pages as required to fully describe the project and material use) and fax it to your TrusSteel engineer prior to bidding and fabrication of trusses in this span range. Your TrusSteel engineer can help you identify and deal with any special design and handling criteria.

Project Data

Fabricator: _____

Project: _____

Project Location: _____

Erection Contractor: _____

Type of building: _____

If a church, is there a steeple? Y / N

Type & height of walls: _____

Number of open sides in building? _____

Name & telephone number of the job Architect or Engineer: _____

_____

Are there any possible interior bearings? Y / N

Can a temporary support be added in the center of the span and be kept there until all permanent bracing is in place? Y / N

Are there any special loads (mechanical units, moveable partitions, dormers, etc.)? Y / N

If so, describe location & size/weight:

_____

Specify any special drainage provisions required for flat or sloping-flat trusses?

_____

Does the erection contractor have the proper lift equipment available? Y / N
(Cranes and spreader bar of proper length)

Notes:

- The Building Designer is responsible for specifying the method of the permanent individual truss member restraint/bracing.
- A Registered Design Professional is responsible for the design of the temporary installation restraint/bracing and the permanent restraint/bracing in accordance with the contracts or construction documents.
- Review the Important Criteria and Recommendations section of this bulletin including the CFSBCSI and CFSEI documents listed there.

CFS Trusses Subject to Corrosive Exposures

Purpose of this Bulletin

The following information is intended as an aid to the professional specifier when designing a building using galvanized cold-formed steel (CFS) members where the building structure will be exposed to a corrosive environment.

Information

Galvanized CFS steel members are typically manufactured using ASTM A653 steel with a G60 zinc coating. And, fasteners used in the construction of CFS steel structures are typically manufactured with a zinc coating. The zinc coatings provide the corrosion protection for the steel members. Refer to Technical Bulletin TB01.09.13, titled “Galvanization Standards”, for other information regarding corrosion protection.

Responsibility

It is the responsibility of the TrusSteel Fabricator to transmit this information to the Engineer of Record or Architect and to assure that they understand it completely. Alpine suggests that TrusSteel fabricators keep a record of their trusses that go into any environments where those trusses may be exposed to a corrosive environment.

It is the responsibility of the Engineer of Record or Architect to determine if the use of CFS steel members is appropriate for use in a specific corrosive environment.

Recommendations

The following are recommendations that are to be followed when specifying CFS steel members for use in a corrosive environment. These recommendations are to be used as a guide to the specifier and they may not be the only recommendations needed to design an adequate corrosion-resistant system.

- Framing members/trusses must be isolated and protected by means of a ceiling vapor barrier.
- Roof areas where framing members/trusses are used to enclose a corrosive environment must be ventilated separately from other roof sections and enclosed areas.
- Framing members/trusses must be periodically inspected for signs of corrosion throughout the life of the structure. Any signs of "red rust" require immediate corrective action. If you choose to use a zinc-rich paint to repair a galvanized surface, you should contact the paint manufacturer and determine if that paint is suitable for use in your specific corrosive exposure.

Included Documents

None.

Revisions

- This bulletin was revised on 1/10/02.

TrusSteel Piggyback Trusses

Purpose of this Bulletin

This Bulletin will provide details and critical information needed for the use of TrusSteel steel trusses in piggyback situations.

Information

Refer to these documents for further information on piggyback trusses:

- Standard Details TS003, TS003A and TS003B for material and connection requirements,
- Technical Bulletin TB98.10.15 for design geometry information,
- TrusSteel Price List for information on available purlin material, hardware and fasteners.

Application

Before designing roof systems and trusses you will want to:

- identify all roof conditions that could require trusses whose height will exceed your maximum allowable truss height (candidates for piggybacking),
- decide what type of continuous framing / support you will use on top of the base trusses (roof decking / sheathing or continuous purlins),
- determine what type of clip you will use to attach the piggyback trusses to the base trusses or to the roof decking / sheathing.

During estimation you will want to account for these materials as well as for the fasteners required to install decking, purlins, clips, etc. You will also want to account for additional labor (if any) that is required to handle these materials and the piggyback trusses.

When designing the layout and trusses for your project, you should note that the TrusSteel SteelVIEW® software does not design piggyback trusses automatically at this time. You can pull trusses from the Layout program, change them into piggyback base trusses, and save them back to the layout as base trusses. You will need to create piggyback trusses in SteelVIEW® as new trusses. You must design the flat top chord of these base trusses using whatever top chord bracing you will use in the field (purlins at 2 ft. o.c. is typical – refer to drawing TS003 and TS003B). See Technical Bulletin TB98.10.15 for charts and details that will assist you in designing piggyback and valley trusses.

When transmitting trusses to Alpine for engineering review, it is very important that you mark and note all piggyback trusses as either “piggyback base truss” or “piggyback top truss”. If you are transmitting the trusses via modem to your regional Alpine engineering office, make this note in the comments box that appears when you Save Truss. If you are transmitting trusses by any other method (fax, mail, etc.), be certain to mark piggyback trusses appropriately on the truss drawing.

Before installing the piggyback trusses, the top chords of base trusses (bottom trusses that will receive and support the top piggyback trusses) must be fully braced with properly installed roof decking / sheathing or continuous purlins. You will want to note this on the erection drawings that you send to the field.

Included Documents

TS003
TS003A
TS003B

Revisions

- This bulletin was revised on 1/10/02 to add references to other standard details.
- This bulletin was revised on 1/15/03 to update all standard details attached to this technical bulletin.

Repair of Galvanized Surfaces

Purpose of this Bulletin

Occasionally it is necessary to repair the surface coating of galvanized chord, web and/or hardware materials. We recommend that you adhere to the following standards when repairing the galvanized surface coating of TrusSteel materials:

- ASTM A780-93a, *"Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings",*
- Society for Protective Coatings Joint Surface Preparation Standard SSPC-SP10 / NACE No. 2, *"Near-White Blast Cleaning"*.

Information

The most commonly used method for repairing damaged galvanized surfaces is the application of a zinc-rich paint. A zinc-rich paint contains zinc dust and, when properly applied, can produce an adequate corrosion resistant finish. A suitable zinc-rich paint should provide a dried film that contains not less than 65% zinc dust by weight. One source would be ZRC Products Company, Quincy, MA, 617-328-6700 (www.zincrich.com).

Application

A summary of the procedure for repairing damaged galvanized surfaces is as follows:

1. Prepare damaged surface by following SSPC-SP10. It is permissible to use a power disk sander to prepare the surface of areas that require repairing. Sand to bright metal as stated in ASTM A780-93a Annex A2.
2. Clean surfaces with industrial solvent to remove dirt, grease and oils. All surfaces must be dry before priming. Note that bare, cleaned metal is extremely susceptible to rusting. Bare, cleaned parts should be kept dry and should be primed as soon as is possible after cleaning.
3. Prime all bare metal areas with "Cold Galvanizing Compound" as made by the ZRC Products Company.
4. By brush or by spray (on all areas to be repaired), apply two coats of "Cold Galvanizing Compound" (by ZRC) totaling a minimum dry film thickness of 0.003 IN, using the manufacturer's printed re-coat directions.
5. Measure the coating thickness to ensure that the minimum dry film thickness (see step #4) has been achieved.

Included Documents

- ASTM A780-93a, *"Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings",*
- Society for Protective Coatings Joint Surface Preparation Standard SSPC-SP10 / NACE No. 2, *"Near-White Blast Cleaning"*.

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Revisions

- This bulletin was revised on 6/5/06.

Uplift Hardware with Attachment Criteria

Purpose of this Bulletin

TrusSteel truss uplift connectors allow TrusSteel trusses to resist specific uplift reactions caused by wind or other loads. All of these connectors attach the truss to the supporting material. Refer to the attached TrusSteel Standard Details for specific fastening requirements.

Available Uplift Hardware

Product Code	***Connect Truss to…***	***Connection Method***	***Std. Detail Reference***
TS6WTC3/TS1WTC3	Structural Steel	screws & weld	TS027
TS6WTC5/TS1WTC5	Structural Steel	screws & weld	TS027A
TS6WTC3/TS1WTC3	CFS	screws & weld	TS027B
TS6WTC5/TS1WTC5	CFS	screws & weld	TS027C
TSUC3	CFS	screws	TS028
TSUC3	Concrete	screws & conc. anchors	TS030
TSUC3	Wood	screws	TS032
TSUC3	Structural Steel	screws & pins	TS039
TSUC3	Structural Steel	screws	TS047
TSUC5	CFS	screws	TS029
TSUC5	Concrete	screws & conc. anchors	TS031
TSUC5	Wood	screws	TS033
TSUC5	Structural Steel	screws & pins	TS040
TSUC5	Structural Steel	screws	TS048
META	Concrete	screws & embedment	TS034 &TS035
TSUC7	Concrete	screws & conc. anchors	TS043
HGT-2	Concrete	screws & epoxy embedment	TS050, TS051, TS052, & TS053
HGT-3	Concrete	screws & epoxy embedment	TS055
HGT-4	Concrete	screws & epoxy embedment	TS054
MTS20/MTS30	Concrete	screws & conc. anchors	TS058
Angle Clip	Concrete	screws & conc. Anchors	TS031A

Using the Total Uplift Capacity Load Tables

Follow these steps when designing connections to resist uplift (UP) loads (resulting from wind or from gravity loads) using TrusSteel hardware:

1. Obtain the uplift load values (in LBS) from *SteelVIEW*®*.
2. Go to the appropriate chart (depending on supporting material) on the Standard Detail.
3. Thoroughly read the notes on the chart, Bottom chord gauge of truss is critical.
4. Select the attachment method that will resist the required uplift.
5. Verify that the top plate will successfully resist all loads (Up, down & lateral).

* Values for reactions can be found in several ways. The reactions are displayed on the steeldraw and/or the calc sheet. Reactions can also be found in TrusCAD after a truss has been analyzed by using the “Reactions” tab or by moving the mouse over the bearing under consideration. For this last option to work the “Show Truscad Data Tips and Tools” option must be checked under the “Configuration” tab in “User Preferences”. Compare the largest negative values to the uplift capacity of the connection. Be sure you identify and consider all reactions (Up, down and lateral).

Hardware Installation

In order to make a successful connection using TrusSteel uplift hardware you must make the connection exactly as specified on the Standard Drawings. When installing self-drilling tapping screws into any material, care must be taken to avoid overdriving and stripping the screws. Stripping of screws significantly lowers their uplift resistance and so the uplift resistance of the entire connection. When making a connection with concrete fasteners, pins or epoxy anchors you must closely follow the manufacturer's installation instructions. When making a connection with a weld, you should always use a qualified welder and good welding procedures. However, welding directly to TrusSteel material is not recommended.

Referenced Documents

TS027	TS032	TS050
TS027A	TS033	TS051
TS027B	TS034	TS052
TS027C	TS035	TS053
TS028	TS039	TS054
TS029	TS040	TS055
TS030	TS043	TS058
TS031	TS047	
TS031A	TS048	

Revisions

- This Bulletin was revised on 4/07/00 to add Standard Detail TS027A.
- This Bulletin was revised on 1/10/02 to add connections and revised part designations.
- This Bulletin was revised on 1/15/03 to add Standard Details TS027B and TS027C to the Available Uplift Hardware chart. All Standard Details associated with this Bulletin have been updated.
- This Bulletin was revised on 10/27/10.

Truss Handling & Bracing

Purpose of this Bulletin

Trusses require extreme care in handling, storage, installing and bracing. Please refer to the following documents regarding these important items:

Important Documents

- **TrusSteel Technical Bulletin TB97.11.26 "Material Handling and Storage Instructions"** – Use as a guideline for TrusSteel material receiving, handling and storage.
- **TrusSteel Technical Bulletin TB99.11.02 "Long Span CFS Trusses"** – Use as a guideline for manufacturing and bracing of trusses with a span equal to or greater than 60 feet (18288 mm).
- **TrusSteel Technical Bulletin TB01.09.14 "Sheathing Attached to TrusSteel Members"** – Use as a guideline on how to properly attach sheathing to TrusSteel members.
- **TrusSteel Technical Bulletin TB17.09.18 "Truss Lateral Restraint"** – Use as a guideline to define the types of lateral restraint for trusses and how the TrusSteel truss design drawings reference lateral restraint for members.
- **CFS BCSI, "Cold-Formed Steel Building Component Safety Information – Guide to Good Practice for Handling, Installing, Restraining & Bracing of Cold-Formed Steel Trusses", published by the Cold-Formed Steel Council (CFSC).** – Use as a guideline for handling, installing, restraining and bracing of TrusSteel trusses.
- **Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses", published by the Cold Formed Steel Engineers Institute (CFSEI)** – Further guidance on how to design permanent bracing for cold-formed steel trusses.
- **AISI S214, "North American Standard for Cold-Formed Steel Framing – Truss Design", published by American Iron and Steel Institute (AISI)** – Further guidance on permanent bracing alternatives.

Application

- **Temporary Bracing** – In the absence of project specific temporary bracing for use in truss installation designed by a registered design professional, refer to chapters B1 and B2 of CFS BCSI for recommended brace material and connections, and for general guidance on safety practices prior to truss installation. Consult a registered design professional if truss span is greater than 60 feet (18288 mm) or truss spacing is greater than 48 inches (1219 mm) o.c.
- **Permanent Bracing** – Permanent bracing members and their connections shall be designed by a registered design professional. For the design of permanent bracing, refer to CFSEI technical note 551e. Alternatively, the Building Designer and/or the registered design professional shall be permitted to specify permanent bracing in accordance with AISI S214 Sections B4.5 and B6.
- **Continuous Lateral Restraint** – Continuous Lateral Restraints (CLR) maintain truss member spacing and provide lateral restraint for the member the CLR is attached to. In order to do that effectively so all truss members do not move simultaneously, the CLR's must be anchored to prevent lateral movement. This anchorage may be provided in various ways. Refer to the CFS BCSI document on techniques to provide this anchorage.

Contact Information

Cold-Formed Steel Engineers Institute (CFSEI)
American Iron and Steel Institute (AISI)
25 Massachusetts Avenue, N.W.
Suite 800
Washington, D.C. 20001
(866) 465-4732 & (202) 425-7100
E-Mail: info@cfsei.org
www.cfsei.org & www.steel.org

Cold-Formed Steel Council (CFSC)
6300 Enterprise Lane
Madison, WI 53719
(608) 274-4849
E-Mail: cfsc@sbcindustry.com
www.cfsc.sbcindustry.com

Revisions

- **This bulletin was revised on 1/10/08**

- **This bulletin was revised on 10/06/10**
- **This bulletin was revised on 9/10/13**
- **This bulletin was revised on 6/08/16**
- **This bulletin was revised on 09/18/17**

SDS Sheets for TrusSteel Products

Purpose of this Bulletin

The purpose of this Bulletin is to provide TrusSteel fabricators with Safety Data Sheets for the cold-formed steel sheet products from which the TrusSteel products are manufactured.

Application

Each TrusSteel fabricator shall keep these documents in their office and shop, and post and distribute them as instructed per local, state, and federal regulations.

Included Documents

- TrusSteel SDS sheet

Glossary of SDS Terms

ACUTE: An adverse effect on the human body with symptoms of high severity coming quickly to a crisis.

ASPHYXIANT: A gas or vapor which can take up space in the air and reduce the concentration of oxygen available in the body. Examples include acetylene, methane, and carbon dioxide. Asphyxiants are of special concern in confined spaces.

BOILING POINT: Temperature at which a liquid changes to a vapor state at a given pressure (usually sea level pressure = 760 mmHg). Mixtures may have a boiling range. Flammable materials with low boiling points usually present special fire hazards.

"C" OR CEILING: The maximum allowable human exposure limit for an airborne substance; not to be exceeded even momentarily. Examples: hydrogen chloride, chlorine, nitrogen dioxide, and some isocyanates have ceiling standards.

CARCINOGEN: A substance that causes cancer.

CC: Cubic centimeter; a volume measurement in the metric system, equal in capacity to one milliliter (ml).

CEILING LIMIT: The maximum amount of a toxic substance allowed to be in workroom air at any time during the day.

CHRONIC EFFECT: An adverse effect on a human or animal body with symptoms which develop slowly or over a long period of time or which recur frequently. The harmful effects resulting from asbestos and silica are considered "chronic effects."

CHRONIC TOXICITY: Adverse (chronic) effects resulting from repeated doses of or exposures to a substance over a relatively prolonged period of time. Ordinarily used to denote effects in experimental animals.

COMBUSTIBLE LIQUID: Any liquid having a flash point at or above 100F (37.8C), but below 200F (93.3C), except any mixture having components with flash points of 200F (93.3C) or higher, the total volume of which make up 99 per cent or more of the total volume of the mixture.

COMMON NAME: Any designation or identification such as code name, code number, trade name, brand name, or generic name used to identify a chemical other than by its chemical name.

CORROSIVE: A liquid or solid that causes visible destruction in skin tissue at the site on contact.

CUTANEOUS HAZARDS: Chemicals which affect the dermal (skin) layer of the body. Signs and symptoms are defatting of the skin, rashes, irritation.

DECOMPOSITION: Breakdown of a material or substance (by heat, chemical reaction, electrolysis, decay, or other processes) into simpler compounds.

DECOMPOSITION PRODUCTS: Describes the hazardous materials produced during heated operations.

DENSITY: The mass of a substance per unit volume. The density of a substance is usually compared to water, which has a density of 1. Substances which float on water have densities less than 1; substances which sink have densities greater than 1.

DERMAL: Used on or applied to the skin.

DERMAL TOXICITY: Adverse effects resulting from skin exposure to a substance. Ordinarily said to denote effects in experimental animals.

DERMATITIS: Inflammation of the skin.

EHS: Environmental Health and Safety office.

EVAPORATION RATE: The rate at which a product will vaporize when compared to the rate of vaporization of a known material (usually Butyl Acetate with rate designated as 1.0). Evaporation rate can be useful in evaluation of health and fire hazards of a material. Rates are classified as fast (greater than 3.0), medium (0.8 to 3.0), and slow (less than 0.9). Evaporation rate of water is 0.3.

EXPLOSIVE: A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

EXPLOSIVE LIMITS: The lowest concentration of a combustible or flammable gas or vapor in air that will produce a flash of fire. Mixtures below this concentration are too "lean" to burn.

EXPOSURE: A person's contact with a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.).

EXTINGUISHING MEDIA: Specifies the fire-fighting agents that should be used to extinguish fires.

FLAMMABLE: Flammable limits describe the range of concentrations of a flammable gas or vapor in air that will produce a flash of fire in the presence of an ignition source. A "flammable liquid" is a solution with a flash point below 100F (37.8C).

FLASH POINT: The temperature at which a liquid will give off enough flammable vapor to ignite. The lower the flash point, the more dangerous the product. A "flammable liquid" is a solution with a flash point below 100F (37.8C). Flash point values are most important when dealing with hydrocarbon solvents. The flash point of a material may vary depending on the method used, so the test method is indicated when the flash point is given.

FORESEEABLE EMERGENCY: Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of hazardous chemical into the workplace.

HAZARDOUS MATERIAL: In a broad sense, any substance or mixture of substances having properties capable of producing adverse effects on the health or safety or a human being.

HAZARD RATINGS: Material ratings of one to four which indicate the severity of hazard with respect to health, flammability, and reactivity.

HAZARD WARNING: Any words, picture, symbols, or combination thereof appearing on a label or other appropriate form of warning which conveys the hazards of the chemical(s) in the container(s).

HEALTH HAZARD: A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

HEPATOTOXINS: Chemicals that produce liver damage.

HVAC: Heating, ventilation and air conditioning.

IGNITABLE: Capable of being set on fire.

INCOMPATIBLE: Materials that could cause dangerous reactions from direct contact with one another. These types of chemicals should never be stored together.

INGESTION: The taking in of a substance through the mouth.

INHALATION: The breathing in of a substance in the form of a gas, vapor, fume, mist, or dust.

IRRITANT: A substance that by contact in sufficient concentration for a sufficient period of time, will cause an inflammatory response or reaction of the eye, skin, or respiratory system. The contact may be a single exposure or multiple exposures.

LC: Lethal Concentration; a concentration of a substance being tested that will kill a test animal.

LETHAL CONCENTRATION 50 (LC50): The concentration of a material in air which on the basis of laboratory tests is expected to kill 50 per cent of a group of test animals when administered as a single exposure (usually 1 to 4 hours).

LD: Lethal Dose; a concentration of a substance being tested that will kill a test animal.

LETHAL DOSE 50 (LD50): A single dose of chemical which on the basis of laboratory tests is expected to kill 50 per cent of a group of test animals. The LD50 dose is usually expressed as milligrams or grams of chemical per kilogram of animal body weight (mg/kg or g/kg).

MELTING POINT: The temperature at which a solid substance changes to a liquid state. For mixtures, the melting range may be given.

MIXTURE: Any combination or two or more chemicals if the combination is not in whole or in part the result of a chemical reaction.

MUTAGEN: Any substance able to induce mutations in DNA and living cells.

NARCOSIS: Stupor or unconsciousness produced by a chemical.

NEPHROTOXINS: Chemicals that produce kidney damage.

NEUROTOXINS: Chemicals that produce their primary toxic effects on the nervous system.

OCCUPATIONAL EXPOSURE LIMITS: Maximum allowable concentrations of toxic substances in workroom air to protect workers who are exposed to toxic substances over a working lifetime.

ORAL TOXICITY: Adverse effects resulting from taking a substance into the body via the mouth. Ordinarily used to denote effects in experimental animals.

OXIDIZER: A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

PERMISSIBLE EXPOSURE LIMITS (PEL's): PEL's are OSHA's legal exposure limits.

pH: A number that describes the acidity of alkalinity or an aqueous solution.

PHYSICAL HAZARD: A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

POLYMERIZATION: A chemical reaction in which one or more small molecules combine to form larger molecules at a rate which releases large amounts of energy. If hazardous polymerization can occur with a given material, the SDS usually will list conditions which could start the reaction; and since the material in most cases contains a polymerization inhibitor, it is usually used up, and no longer capable of preventing a reaction.

PPM (Parts Per Million): Parts of vapor or gas per million parts of contaminated air by volume.

PPB (Parts Per Billion): Parts of vapor or gas per billion parts of contaminated air by volume.

PPE: Personal Protective Equipment.

REACTIVITY: A description of the tendency of a substance to undergo chemical reaction with the release of energy. Undesirable effects such as pressure build-up, temperature increase, formation of noxious, toxic or corrosive byproducts may occur because of the reactivity of a substance by heating, burning, direct contact with other materials, or other conditions in use or in storage.

SENSITIZER: A substance which on first exposure causes little or no reaction but which on repeated exposure may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form of sensitization in the industrial setting, although respiratory sensitization to a few chemicals is also known to occur.

SHIPPING INFORMATION: The appropriate name(s), hazard class(es), and identification number(s) as determined by the United States Department of Transportation, International Regulations, and the International Civil Aviation Organization.

SOLUBILITY: The extent to which a substance mixes with a liquid to produce a solution.

SOLVENT: Usually a liquid in which other substances are dissolved. The most common solvent is water.

SPECIFIC GRAVITY: The ratio of the weight of a given volume of any substance to the weight of an equal volume of water.

STABILITY: An expression of the ability of a material to remain unchanged under expected and reasonable conditions of storage and use.

TERATOGEN: Any substance that causes growth abnormalities in embryos, genetic modifications in cells, etc.

THRESHOLD LIMIT VALUES (TLV's): Expresses the airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects. TLV's are expressed three ways:

1. TLV-TWA: The allowable Time Weighted Average concentration for a normal 8-hour workday (40-hour work week).

2. TLV-STEL: The short-term exposure limit or maximum concentration for a continuous 15-minute exposure period (maximum of four such periods per day, with at least 60 minutes between exposure periods) and provided the TLV-TWA is not exceeded.

3. TLV-C: The ceiling exposure limit is the concentration that should never be exceeded, even instantaneously.

TOXICITY: The sum of adverse effects resulting from exposure to a material, generally by the mouth, skin, or respiratory tract.

TWA (Time Weighted Average exposure): The airborne concentration of a material to which a person is exposed, averaged the total exposure time; generally the total workday (8 to 12 hours).

VAPOR DENSITY: The density of a material's vapor, compared to the density of the air. If a vapor density is greater than one, it is denser than air and it will drop to the floor or the lowest point available. If the density is less than one, it is lighter than air and will float upwards like helium.

VAPOR PRESSURE: The pressure exerted at a given temperature of a vapor in equilibrium with its liquid or solid. The higher the vapor pressure, the more easily a liquid will evaporate. Liquid materials that evaporate easily are termed volatile, and this means that air concentrations can build up quickly when working with the material in liquid form. Materials with high vapor pressures may be particularly hazardous if you are working in enclosed or confined areas, or if the air circulation is poor. Note: Materials with lower vapor pressure still may pose an inhalation hazard.

WATER REACTIVE: A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Revisions

- This bulletin was revised on 1/10/02
- This bulletin was revised on 10/26/10
- This bulletin was revised on 03/04/13
- This bulletin was revised on 01/30/17

SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade Name: Sheet Steel
CAS Number: Not applicable
Synonyms: Hot Band, Cold Rolled, P&O, Galvanized
Use/Description: Steel for thin gauge products and sheet steel for Castrip®

Company Identification:	**24 Hour Contact – CHEMTREC 1-800-424-9300**
Nucor Steel – Arkansas 7301 E. County Road 142 Blytheville, AR 72315	Safety Officer [8:00 am – 5:00 pm]: 1-(870) 762-2100
Nucor Steel – Berkeley 1455 Hagan Avenue Huger, SC 29450	Safety Officer [8:00 am – 5:00 pm]: 1-(843) 336-6000
Nucor Steel Decatur, LLC 4301 Iverson Boulevard Trinity, AL 35673	Safety Officer [8:00 am – 5:00 pm]: 1-(256) 301-3500
Nucor Steel – Indiana Castrip 4537 South Nucor Road Crawfordsville, IN 47933	Safety Officer [8:00 am – 5:00 pm]: 1-(765) 364-1323
Nucor Steel Gallatin 4831 U.S. Hwy 42 West Ghent, KY 41045	Safety Officer [8:00 am – 5:00 pm]: 1-(859) 567-3100

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

STEEL PRODUCTS AS SOLD BY NUCOR ARE NOT HAZARDOUS PER OSHA GHS 29 CFR 1910, 1915, 1926. However, individual customer processes, (such as welding, sawing, brazing, grinding, abrasive blasting, and machining) may result in the formation of fumes, dust (combustible or otherwise), and/or particulate that may present the following hazards:

OSHA Hazards:
Carcinogen
Skin Sensitizer
Target Organ Effect – Lungs

GHS Classification:
Carcinogenicity (Category 2)
Skin Sensitization (Category 1)
Specific Target Organ Toxicity-Repeated Exposure (Category 1)

Pictogram(s):

Signal Word: Danger

Hazard Statement(s)
H317: Dust/fumes may cause an allergic skin reaction.
H351: Dust/fumes suspected of causing cancer via inhalation.
H372: Inhalation of dust/fumes causes damage to respiratory tract through prolonged or repeated exposure

Precautionary Statement(s)
P202: Do not handle until all safety precautions have been read and understood.
P261: Avoid breathing dust/fumes.
P281: Use personal protective equipment as required.
P308+P313: If exposed or concerned: Get medical advice/attention.

Potential Health Effects

Eye Contact
Dusts or particulates may cause mechanical irritation including pain, tearing, and redness. Scratching of the cornea can occur if eye is rubbed. Fumes may be irritating. Contact with the heated material may cause thermal burns.

Skin Contact
Dusts or particulates may cause mechanical irritation due to abrasion. Coated steel may cause skin irritation in sensitive individuals (see Section 16 for additional information.) Some components in this product are capable of causing an allergic reaction, possibly resulting in burning, itching and skin eruptions. Contact with heated material may cause thermal burns.

Inhalation
Dusts may cause irritation of the nose, throat, and lungs. Excessive inhalation of metallic fumes and dusts may result in metal fume fever, an influenza-like illness. It is characterized by a sweet or metallic taste in the mouth, accompanied by dryness and irritation of the throat, cough, shortness of breath, pulmonary edema, general malaise, weakness, fatigue, muscle and joint pains, blurred vision, fever and chills. Typical symptoms last from 12 to 48 hours.

Ingestion
Not expected to be acutely toxic via ingestion based on the physical and chemical properties of the product. Swallowing of excessive amounts of the dust may cause irritation, nausea, and diarrhea.

Potential Fire and Explosion Hazards
Under normal conditions, steel products do not present fire or explosion hazards, and dust generated by handling steel products is oxidized and not combustible. Processing of steel product by some individual customers may produce potentially combustible dust that may represent a fire or explosion hazard.

Chronic or Special Toxic Effects
Repeated exposure to fine dusts may inflame the nasal mucosa and cause changes to the lung. In addition, a red-brown pigmentation of the eye and/or skin may occur. Welding fumes have been associated with adverse health effects. Contains components that may cause cancer or reproductive effects. The following components are listed by NTP, OSHA, or IARC as carcinogens: Nickel, chromium (hexavalent), cobalt, lead, cadmium, antimony (trioxide), arsenic, beryllium. See Section 11, for additional, specific information on effects noted above.

Target Organs
Overexposure to specific components of this product that are generated in dusts or fumes may cause adverse effects to the following organs or systems: eyes, skin, liver, kidney, central nervous system, cardiovascular system, respiratory system,.

Medical Conditions Aggravated by Exposure
Diseases of the skin such as eczema may be aggravated by exposure. Also, disorders of the respiratory system including asthma, bronchitis, and emphysema. Long-term inhalation exposure to agents that cause pneumoconiosis (e.g. dust) may act synergistically with inhalation of oxide fumes or dusts of this product.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS No.	% Weight	Exposure Limits			
			ACGIH TLV (mg/m^3)		OSHA PEL (mg/m^3)	
Base Metal:						
Iron (Fe)	7439-89-6	Balance	5	Oxide Dust/Fume	10	Oxide Dust/Fume
Alloying Elements						

Components		CAS No.	% Weight	Exposure Limits			
				ACGIH TLV (mg/m^3)		OSHA PEL (mg/m^3)	
Aluminum	(Al)	7429-90-5	0-3.0	10 5	Dust Fume	15 5	Dust Respirable fraction
Antimony	(Sb)	7440-36-0	<0.9	0.5	As Antimony	0.5	As Antimony
Arsenic	(As)	7440-38-2	<0.09	0.01	As Arsenic (A1 Carcinogen)	0.01	As Arsenic
Beryllium	(Be)	7440-41-7	<0.09	0.002 0.01	As Beryllium (A1 Carcinogen) As Beryllium (STEL)	0.002 0.005	As Beryllium As Beryllium (Ceiling)
Boron	(B)	7440-42-8	<1.1	10	Oxide Dust	15	Oxide Dust
Cadmium	(Cd)	7440-43-9	<0.01	0.01 0.002	As Cadmium (A2 Carcinogen) Respirable fraction	0.005 0.0025	As Cadmium As Cadmium (Action Level)
Calcium	(Ca)	1305-78-8	<0.9	2	Oxide Dust	5	Oxide Dust
Carbon	(C)	7440-44-0	<1.0		Not Established		Not Established
Chromium	(Cr)	7440-47-3	0.01-12.5	0.5	Metal	1	Metal
Cobalt	(Co)	7440-48-4	<0.09	0.02	As Cobalt (A3 Carcinogen)	0.1	Metal/Dust/Fume
Copper	(Cu)	7440-50-8	<3.5	1 0.2	Dust Fume	1 0.1	Dust Fume
Lead	(Pb)	7439-92-1	0.0-0.04	0.05	Dust / Fume (A3 Carcinogen)	0.05	Dust / Fume
Magnesium	(Mg)	7439-95-4	<0.9		Not Established		Not Established
Manganese	(Mn)	7439-96-5	<16.0	0.2	Elemental Mn and Inorg Compounds	5	Fume (Ceiling)
Molybdenum	(Mo)	7439-98-7	<1.1	10	Insoluble Compounds	15	Insoluble Compounds
Niobium	(Nb)	7440-03-1	<0.9		Not Established		
Nickel	(Ni)	7440-02-0	0.01-3.0	1.5	Metal	1	Metal and Insoluble Compounds
Nitrogen	(N)	7727-37-9	<0.9		Simple Asphyxiant		Simple Asphyxiant
Phosphorus	(P)	7723-14-0	<0.9	0.1	Phosphorus	0.1	Phosphorus
Selenium	(Se)	7782-49-2	<0.9	0.2	Selenium	0.2	Selenium
Silicon	(Si)	7440-21-3	0.0-5.0	10	Dust	15	Dust
Sulfur	(S)	7446-09-05	<0.9	5.2 13	Sulfur Dioxide Sulfur Dioxide (STEL)	13	Sulfur Dioxide
Tin	(Sn)	7440-31-5	<0.9	2	Metal,Oxide and Inorganic Compounds	2	Inorganic Compounds
Titanium	(Ti)	7440-32-6	<0.9		Not Established		Not Established
Tungsten	(W)	7440-33-7	<0.9	5 10	Insoluble Compounds as W Insoluble Compounds as W (STEL)		Not Established
Vanadium	(V)	7440-62-2	<0.9	0.05	Oxide Dust/Fume	0.5 0.1	Oxide Dust (Ceiling) Oxide Fume (Ceiling)
Zinc	(Zn)	7440-66-6	0.0-0.1	10 5 10	Oxide Dust OxideFume Oxide Fume (STEL)	5 10	Oxide Fume Oxide Dust
Coatings and Finishing Treatments:							
Hydrochloric Acid	(HCl)	7647-01-0	<3				
Petroleum, Natural or Synthetic oils		Mixture	<0.1	5	Mist	5	Mist
Anhydrous Potassium Hydroxide		1310-58-3	<0.01	2	Ceiling	2	Ceiling
Glycine,nn-1,2-ethanediylbis		60-00-4	<0.01				
Polyalkylene glycol		Mixture	<0.01				

Components	CAS No.	% Weight	Exposure Limits			
			ACGIH TLV (mg/m^3)		OSHA PEL (mg/m^3)	
Sodium nitrite	7632-00-0	<0.01	10	Oxide Dust		
Zinc (galvanized)	7440-66-6	0.4 - 10	5 10	OxideFume Oxide Fume (STEL)	5 10	Oxide Fume Oxide Dust

NOTE: No permissible exposure limits (PEL) or threshold limit values (TLV) exist for steel over all. The above listing is a summary of elements used in normal Nucor Steel Products. Various grades of steel will contain different combinations of these elements and/or trace materials. Exact specifications for specific products may be available upon request.

4. FIRST AID MEASURES

Eye Contact- In case of overexposure to dusts or fumes, immediately flush eyes with plenty of water for at least 15 minutes occasionally lifting the eye lids. Get medical attention if irritation persists. Thermal burns should be treated as medical emergencies.
Skin Contact - In case of overexposure to dusts or particulates, wash with soap and plenty of water. Get medical attention if irritation develops or persists. If thermal burn occurs, flush area with cold water and get immediate medical attention.
Inhalation - In case of overexposure to dusts or fumes, remove to fresh air. Get immediate medical attention if symptoms described in this SDS develop.
Ingestion - Not considered an ingestion hazard. However, if excessive amounts of dust or particulates are swallowed, treat symptomatically and supportively. Get medical attention.
Notes to Physician - Inhalation of metal fume or metal oxides may produce an acute febrile state, with cough, chills, weakness, and general malaise, nausea, vomiting, muscle cramps, and remarkable leukocytosis. Treatment is symptomatic, and condition is self limited in 24-48 hours. Chronic exposure to dusts may result in pneumoconiosis of mixed type.

5. FIRE FIGHTING MEASURES

Flash Point (Method) - Not applicable
Flammable Limits (% volume in air) - Not applicable
Auto ignition Temperature - Not applicable
Extinguishing Media - For molten metal, use dry powder or sand. For steel dust use or dry sand, water, foam, argon or nitrogen.
Special Fire Fighting Procedures - Do not use water on molten metal. Do not use Carbon Dioxide (CO_2). Firefighters should not enter confined spaces without wearing NIOSH/MSHA approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.
Unusual Fire or Explosion Hazards - Steel products do not present fire or explosion hazards under normal conditions. Any non-oxidized fine metal particles/ dust generated by grinding, sawing, abrasive blasting, or individual customer processes may produce materials that the customer should test for combustibility and other hazards in accordance with applicable regulations. High concentrations of combustible metallic fines in the air may present an explosion hazard.

6. ACCIDENTAL RELEASE MEASURES

Precautions if Material is Spilled or Released - Emergency response is unlikely unless in the form of combustible dust. Avoid inhalation, eye, or skin contact of dusts by using appropriate precautions outlined in this SDS (see section 8). Fine turnings and small chips should be swept or vacuumed and placed into appropriate disposable containers. Keep fine dust or powder away from sources of ignition. Scrap should be reclaimed for recycling. Prevent materials from entering drains, sewers, or waterways.
Fire and Explosion Hazards - Some customer processes may generate combustible dust that may require specific precautions when cleaning spills or releases of dust.
Environmental Precautions - Some grades of steel may contain reportable quantities of alloying elements. See Section 15 for additional information.
Waste Disposal Methods - Dispose used or unused product in accordance with applicable Federal, State, and Local regulations. Please recycle.

7. HANDLING AND STORAGE

Storage Temperatures - Stable under normal temperatures and pressures.
Precautions to be Taken in Handling and Storing - Store away from strong oxidizers. Dusts and/or powders, alone, or combined with process specific fluids, may form explosive mixtures with air. Applicable Federal, state and local laws and regulations may require testing dust generated from processing of steel products to determine if it represents a fire or explosion hazard and to determine appropriate protection methods. Avoid breathing dusts or fumes.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Operations with potential for generating high concentrations of airborne particulates or fumes should be evaluated and controlled as necessary.
Eye Protection - Use safety glasses. Dust resistant safety goggles are recommended under circumstances where particles could cause mechanical injury such as grinding or cutting. Face shield should be used when welding or cutting.
Skin - Appropriate protective gloves should be worn as necessary. Good personal hygiene practices should be followed including cleansing exposed skin several times daily with soap and water, and laundering or dry cleaning soiled work clothing.
Respiratory Protection - NIOSH/MSHA approved dust/fume/mist respirator should be used to avoid excessive exposure. See Section 3 for component material information exposure limits. If such concentrations are sufficiently high that this respirator is inadequate, or high enough to cause oxygen deficiency, use a positive pressure self-contained breathing apparatus (SCBA). Follow all applicable respirator use, fitting, and training standards and regulations.
Ventilation - Provide general and/or local exhaust ventilation to control airborne levels of dust or fumes below exposure limits.
Exposure Guidelines - No permissible exposure limits (PEL) or threshold limit values (TLV) exist for steel. See Section 3 for component materials. Various grades of steel will contain different combinations of these elements. Trace elements may also be present in minute amounts.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor – Silver grey to grey black with metallic luster.
Boiling Point - Not applicable
Melting Point - Approximately 2800 ^{o}F
pH - Not applicable
Specific Gravity (at 15.6^{o}C) - Not applicable
Density (at 15.6 ^{o}C) - Not applicable
Vapor Pressure - Not applicable
Vapor Density (air = 1) - Not applicable
% Volatile, by Volume - Not applicable
Solubility in Water - Insoluble.
Evaporation Rate (Butyl Acetate = 1) - Not applicable
Other Physical and Chemical Data - None

10. STABILITY AND REACTIVITY

Stability - Stable
Conditions to Avoid - Steel at temperatures above the melting point may liberate fumes containing oxides of iron and alloying elements. Avoid generation of airborne fume.
Hazardous Polymerization - Will not occur.
Incompatibility (Materials to Avoid) - Reacts with strong acids to form hydrogen gas. Do not store near strong oxidizers.
Hazardous Decomposition Products - Metallic fumes may be produced during welding, burning, grinding, and possibly machining or any situation with the potential for thermal decomposition. Refer to ANSI Z49.1

11. TOXICOLOGICAL INFORMATION

The primary component of this product is iron. Long-term exposure to iron dusts or fumes can result in a condition called siderosis which is considered to be a benign pneumoconiosis. Symptoms may include chronic bronchitis, emphysema, and shortness of breath upon exertion. Penetration of iron particles in the skin or eye may cause an exogenous or ocular siderosis which may be characterized by a red-brown pigmentation of the affected area. Ingestion overexposures to iron may affect the gastrointestinal, nervous, and hematopoietic system and the liver. Iron and steel founding, but not iron or iron oxide, has been listed as carcinogenic (Group 1) by IARC.

When this product is welded, fumes are generated. Welding fumes may be different in composition from the original welding product, with the chief component being ordinary oxides of the metal being welded. Chronic health effects (including cancer) have been associated with the fumes and dusts of individual component metals (see above), and welding fumes as a general category have been listed by IARC as a carcinogen (Group 2B). There is also limited evidence that welding fumes may cause adverse reproductive and fetal effects. Evidence is stronger where welding materials contain known reproductive toxins, e.g., lead which may be present in the coating material of this product.

Breathing fumes or dusts of this product may result in metal fume fever, which is an illness produced by inhaling metal oxides. These oxides are produced by heating various metals including cadmium, zinc, magnesium, copper, antimony, nickel, cobalt, manganese, tin, lead, beryllium, silver, chromium, aluminum, selenium, iron, and arsenic. The most common agents involved are zinc and copper.

This product may contain small amounts of manganese. Prolonged exposure to manganese dusts or fumes is associated with "manganism", a Parkinson-like syndrome characterized by a variety of neurological symptoms including muscle spasms, gait disturbances, tremors, and psychoses.

This product may contain small amounts of cadmium. Primary target organs for cadmium overexposure are the lung and the kidney. Because of its cumulative nature, chronic cadmium poisoning can cause serious disease which takes many years to develop and may continue to progress despite cessation of exposure. Progression of the disease may not reflect current exposure conditions. It is also capable of causing a painful osteomalacia called “Itai-Itai” in postmenopausal women, and has caused developmental effects and/or reproductive effects in male and female animals. Cadmium is a listed carcinogen by NTP, OSHA, and IARC (Group 1).

This product may contain small amounts of chromium. Prolonged and repeated overexposure to chromium dusts or fumes may cause skin ulcers, nasal irritation and ulceration, kidney damage and cancer of the respiratory system. Chromium is skin sensitizer. Cancer is generally attributed to the hexavalent (+6) form of chromium which is listed as a carcinogen by NTP and IARC (Group 1).

This product may contain small amounts of nickel. Prolonged and repeated contact with nickel may cause sensitization dermatitis. Inhalation of nickel compounds has caused lung damage as well as sinus, nasal and lung cancer in laboratory animals. Nickel is a listed carcinogen by NTP and IARC (Group 1).

This product may contain small amounts of vanadium. Adverse effects from dermal, inhalation or parenteral exposure to various vanadium compounds have been reported. The major target for vanadium pentoxide toxicity is the respiratory tract. Fumes or dust can cause severe eye and respiratory irritation, and systemic effects. Chronic bronchitis, green tongue, conjunctivitis, pharyngitis, rhinitis, rales, chronic productive cough, and tightness of the chest have been reported following overexposure. Allergic reactions resulting from skin and inhalation exposures have also been reported. A statistical association between vanadium air levels and lung cancer has been suggested, but vanadium currently is not regarded as a human carcinogen.

This product may contain small amounts of lead. Lead can accumulate in the body. Consequently, exposure to fumes or dust may produce signs of polyneuritis, diminished vision and peripheral neuropathy, such as tingling and loss of feeling in fingers, arms and legs. Lead is a known reproductive and developmental toxin. It is also associated with central nervous system disorders, anemia, kidney dysfunction and neurobehavioral abnormalities. The brain is a major target organ for lead exposure. Elemental lead is listed as an IARC 2B carcinogen.

The product may contain small amounts of copper. Copper dust and fumes can irritate the eyes, nose and throat causing coughing, wheezing, nosebleeds, ulcers and metal fume fever. Other effects from repeated inhalation of copper fumes include a metallic or sweet taste, and discoloration of skin, teeth or hair. Copper also may cause an allergic skin reaction. Overexposure to copper can affect the liver.

12. ECOLOGICAL INFORMATION

Aquatic Ecotoxicological Data - No specific information available on this product.
Environmental Fate Data - No specific information available on this product.

13. DISPOSAL CONSIDERATIONS

Recovery and reuse, rather than disposal, should be the ultimate goal of handling efforts. Dispose in accordance with federal, state, and local health and environmental regulations. Prevent materials from entering drains, sewers, or waterways.

14. TRANSPORT INFORMATION

DOT Proper Shipping Name - Not regulated
DOT Hazard Classification - Not regulated
UN/NA Number - Not applicable
DOT Packing Group - Not applicable
Labeling Requirements - Not applicable
Placards - Not applicable
DOT Hazardous Substance - Not applicable
DOT Marine Pollutant - Not applicable

15. REGULATORY INFORMATION

This product is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200. However, dusts and fumes from this product may be combustible or hazardous and require protection to comply with applicable Federal, state and local laws and regulations.

California Proposition 65: This product contains chemicals (antimony [oxide], arsenic, beryllium, chromium [hexavalent], cobalt, cadmium, lead, nickel) known to the State of California to cause cancer and chemicals (cadmium, lead) known to the State of California to cause birth defects or other reproductive harm.

Massachusetts Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Hydrochloric acid, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

Pennsylvania Hazardous Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Hydrochloric acid, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

New Jersey Hazardous Substance List: Aluminum, Antimony, Arsenic, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Hydrochloric acid, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrogen, Phosphorus, Selenium, Silicon, Sulfur, Tin, Titanium, Tungsten, Vanadium, Zinc

Toxic Substances Control Act (TSCA)
Components of this product are listed on the TSCA Inventory.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
Steel is not reportable, however, it contains hazardous substances that may be reportable if released in pieces with diameters less than or equal to 0.004 inches (RQ marked with a "*").

Chemical Name	Reportable Quantity (in lb)
Antimony	5000*
Arsenic	1*

Chemical Name	Reportable Quantity (in lb)
Beryllium	10*
Cadmium	10*
Chromium	5000*
Copper	5000*
Lead	10*
Nickel	100*
Phosphorus	1
Selenium	100*
Zinc	1000*

Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III

SECTION 311/312 HAZARD CATEGORIES: Immediate Health Effect, Delayed Health Effect

This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right – To – Know Act of 1986 (40 CFR 372):

SECTION 313 REPORTABLE INGREDIENTS:

Chemical Name	CAS Number	Concentration (% by weight)	Reportable
Aluminum	7429-90-5	0.0-0.01 Some grades up to 3.0%	Yes –Greater than 1%
Antimony	7440-36-0	<0.9	No – Less than 1%
Arsenic	7440-38-2	<0.09	No – Less than 0.1%
Beryllium	7440-41-7	<0.09	No – Less than 0.1%
Cadmium	7440-43-9	<0.01	No – Less than 0.1%
Chromium	7440-47-3	0.01-1.0 Some grades up to 12.5%	Yes – Greater than 0.1%
Cobalt	7440-48-4	<0.09	No – Less than 0.1%
Copper	7440-50-8	<0.9 Some grades up to 3.5%	Yes –Greater than 1%
Lead	7439-92-1	0.0-0.04	Yes
Manganese	7439-96-5	0.2-2 Some grades up to 16.0%	Yes – Greater than 1%
Nickel	7440-02-0	0.01-0.1 Some grades up to 3.0%	Yes – Greater than 0.1%
Phosphorus	7723-14-0	<0.9	No – Less than 1%
Selenium	7782-49-2	<0.9	No – Less than 1%
Vanadium	7440-62-2	<0.9	No – Less than 1%
Zinc	7440-66-6	<0.01	No – Less than 1%

Concentrations based on analytical data and process knowledge of typical products distributed by the facility.

16. OTHER INFORMATION

This SDS covers Nucor product as delivered from the Nucor facility, but does not include chemicals that may be applied by subsequent handlers and/or distributors of this product. This could include a variety of materials including oils, paints, galvanization, etc. that are not included in this SDS. Additionally, specialty orders may require application of coating material not listed in this SDS. SDSs for any Nucor-applied specialty coating will be provided separately. During welding, precautions should be taken for airborne contaminants that may originate from components of the welding rod. Arc or spark generated when welding or burning could be a source of ignition for combustible and/or flammable materials. The information in this Safety Data Sheet (SDS) was obtained from sources which we believe are reliable; however, the information is provided without any representation or warranty, expressed or implied, regarding the accuracy or correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage, or expense arising out of or in any way connected with the handling, storage, use, or disposal of this product.

SAFETY DATA SHEET

1. Identification

Product identifier **Cold Rolled Galvanized**

Other means of identification None.

Recommended use Steel Fabricated Parts.

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Company name	Steel Dynamics, Inc.	
Address	4500 County Road 59 Butler, IN 46721 US US	
Telephone	Telephone	260-868-8000
E-mail	Not available.	
Contact person	Safety Department	
Emergency phone number	Emergency Telephone	800-424-9300

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word None.

Hazard statement None.

Precautionary statement

Prevention Avoid creating dust.

Response Wash skin with soap and water.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information

In its manufactured and shipped state, this product is considered non-hazardous. Processing may generate hazardous fumes and dusts. Welding, cutting and metalizing can generate ozone. Ozone can cause irritation of eyes, nose and respiratory tract.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Iron	7439-89-6	90-100
Manganese	7439-96-5	0-2
Chromium	7440-47-3	0-1
Silicon	7440-21-3	0-1
Nickel	7440-02-0	0-0.4
Vanadium	7440-62-2	0-0.2
Iron oxide**	1309-37-1	0

Vanadium pentoxide**	1314-62-1	0
Zinc oxide**	1314-13-2	0

The product is an alloy. May liberate hazardous oxides such as iron oxides and vanadium pentoxide at temperatures above the melting point. The surface is galvanized with zinc. The surface may be passivated with chromic acid leaving residual coating of chrome III and VI compounds. The product may be coated with acrylic coating. The steel is treated with mineral oil.

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.
**Iron oxide and vanadium pentoxide are formed at temperatures above the melting point. **Zinc oxide fumes may be formed during burning, cutting, or welding.

4. First-aid measures

Inhalation In case of inhalation of fumes from heated product: Move into fresh air and keep at rest. Get medical attention if symptoms persist. If breathing is difficult, give oxygen. If breathing stops, provide artificial respiration.

Skin contact Wash skin with soap and water. In case of burns with hot metal, rinse with plenty of cold water. If burns are severe, consult a physician. If skin irritation or an allergic skin reaction develops, get medical attention.

Eye contact Any material that contacts the eye should be washed out immediately with water. If easy to do, remove contact lenses. Get medical attention promptly if symptoms persist or occur after washing.

Ingestion Solid steel: Not applicable. Dust: Get medical attention if any discomfort continues.

Most important symptoms/effects, acute and delayed High concentrations of freshly formed fumes/dusts of metal oxides can produce symptoms of metal fume fever. Typical symptoms last 12 to 48 hours and are characterized by metallic taste in the mouth, dryness, and irritation of the throat, followed by weakness, muscle pain, fever, and chills.

5. Fire-fighting measures

Suitable extinguishing media No unusual fire or explosion hazards noted. Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical At temperatures above the melting point, may liberate fumes of iron, nickel, and zinc oxide.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Cold solid metal: No special precautions are necessary beyond normal good hygiene practices. See Section 8 of the SDS for additional personal protection advice when handling this product. Hot metal: Avoid contact with hot material. Wear protective clothing as described in Section 8 of this safety data sheet.

Methods and materials for containment and cleaning up In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

Collect for recycling.

Environmental precautions No specific precautions.

7. Handling and storage

Precautions for safe handling Oil coating can make material slippery. Avoid contact with sharp edges and hot surfaces. Use appropriate gloves and tools to ensure safe handling. Use work methods which minimize dust/fume production. Do not breathe fumes and dusts. Observe safety measures suited to the coating(s) when handling, cutting or melting. Follow the recommendations in ANSI Z49.1, Safety in welding and cutting (ANSI=American National Standard Institute). Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities Store in a dry place. Store away from: Oxidizing agents. Acids.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Chromium (CAS 7440-47-3)	PEL	1 mg/m3	
Iron oxide** (CAS 1309-37-1)	PEL	10 mg/m3	Fume.
Manganese (CAS 7439-96-5)	Ceiling	5 mg/m3	Fume.
Nickel (CAS 7440-02-0)	PEL	1 mg/m3	
Silicon (CAS 7440-21-3)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Vanadium pentoxide** (CAS 1314-62-1)	Ceiling	0.5 mg/m3	Respirable dust.
		0.1 mg/m3	Fume.
Zinc oxide** (CAS 1314-13-2)	PEL	5 mg/m3	Respirable fraction.
		5 mg/m3	Fume.
		15 mg/m3	Total dust.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Chromium (CAS 7440-47-3)	TWA	0.5 mg/m3	
Iron oxide** (CAS 1309-37-1)	TWA	5 mg/m3	Respirable fraction.
Nickel (CAS 7440-02-0)	TWA	1.5 mg/m3	Inhalable fraction.
Vanadium pentoxide** (CAS 1314-62-1)	TWA	0.05 mg/m3	Inhalable fraction.
Zinc oxide** (CAS 1314-13-2)	STEL	10 mg/m3	Respirable fraction.
	TWA	2 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Chromium (CAS 7440-47-3)	TWA	0.5 mg/m3	
Iron oxide** (CAS 1309-37-1)	TWA	5 mg/m3	Dust and fume.
Manganese (CAS 7439-96-5)	STEL	3 mg/m3	Fume.
	TWA	1 mg/m3	Fume.
Nickel (CAS 7440-02-0)	TWA	0.015 mg/m3	
Silicon (CAS 7440-21-3)	TWA	5 mg/m3	Respirable.
		10 mg/m3	Total
Vanadium (CAS 7440-62-2)	STEL	3 mg/m3	
	TWA	1 mg/m3	
Vanadium pentoxide** (CAS 1314-62-1)	Ceiling	0.05 mg/m3	Fume.
		0.05 mg/m3	Dust.
Zinc oxide** (CAS 1314-13-2)	Ceiling	15 mg/m3	Dust.
	STEL	10 mg/m3	Fume.
	TWA	5 mg/m3	Fume.
		5 mg/m3	Dust.

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines **Iron oxide and vanadium pentoxide are formed at temperatures above the melting point. **Zinc oxide fumes may be formed during burning, cutting, or welding.

Appropriate engineering controls Adequate ventilation should be provided so that exposure limits are not exceeded. Use local exhaust when welding, burning, sawing, brazing, grinding or machining to prevent excessive dust or fume exposure.

Individual protection measures, such as personal protective equipment

Eye/face protection	Use of safety glasses or goggles is required for welding, burning, sawing, brazing, grinding or machining operations. In addition to safety glasses or goggles, a welding helmet with appropriate shaded shield is required during welding, burning, or brazing. A face shield is recommended, in addition to safety glasses or goggles, during sawing, grinding, or machining.
Skin protection	
Hand protection	Wear protective gloves.
Other	Wear suitable protective clothing.
Respiratory protection	Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits.
Thermal hazards	When material is heated, wear gloves to protect against thermal burns. Thermally protective apron and long sleeves are recommended when volume of hot material is significant.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Observe any medical surveillance requirements.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Rolled steel.
Color	Metallic gray.
Odor	None.
Odor threshold	Not applicable.
pH	Not applicable.
Melting point/freezing point	2750 °F (1510 °C) / Not applicable.
Initial boiling point and boiling range	Not applicable.
Flash point	Not applicable.
Evaporation rate	Not applicable.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable.
Flammability limit - upper (%)	Not applicable.
Explosive limit - lower (%)	Not applicable.
Explosive limit - upper (%)	Not applicable.
Vapor pressure	Not applicable.
Vapor density	Not applicable.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not applicable.
Partition coefficient (n-octanol/water)	Not applicable.
Auto-ignition temperature	Not applicable.
Decomposition temperature	Not applicable.
Viscosity	Not applicable.

10. Stability and reactivity

Reactivity	Stable at normal conditions.
Chemical stability	This product is stable under expected conditions of use.
Possibility of hazardous reactions	Will not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong acids. Oxidizing agents.

Hazardous decomposition products	At elevated temperatures: Acrid fumes. Metallic fumes. Strong Acid Contact: Hydrogen.

11. Toxicological information

Information on likely routes of exposure

Inhalation	No inhalation hazard under normal conditions. Welding, burning, sawing, brazing, grinding or machining operations may generate fumes and dusts of metal oxides. Inhalation of dust (generated at high temperatures only) or oil mist from this product may cause mild irritation of the upper respiratory tract. Fumes released during processing of mineral oil treated steel surface may cause irritation to the respiratory system. High concentrations: Repeated and prolonged overexposure to oil mists may result in droplet deposition, oil granuloma formation, inflammation and increased incidence of infection in the respiratory tract.
Skin contact	Under normal conditions of intended use, this material does not pose a risk to health. Dust may irritate skin. Oil coating may cause temporary irritation to skin. Skin contact may aggravate an existing dermatitis. Contact with hot material can cause thermal burns which may result in permanent damage.
Eye contact	Under normal conditions of intended use, this material does not pose a risk to health. Contact with hot material can cause thermal burns which may result in permanent damage. Grinding and sanding this product may generate dust. Dust may irritate the eyes.
Ingestion	Solid steel: Not relevant, due to the form of the product. However, ingestion of dusts generated during working operations may cause nausea and vomiting.
Symptoms related to the physical, chemical and toxicological characteristics	Exposed individuals may experience eye tearing, redness, and discomfort. May dry the skin leading to discomfort and dermatitis. Prolonged contact may cause redness, irritation and cracking. High concentrations of freshly formed fumes/dusts of metal oxides can produce symptoms of metal fume fever. Typical symptoms last 12 to 48 hours and are characterized by metallic taste in the mouth, dryness, and irritation of the throat, followed by weakness, muscle pain, fever, and chills. Exposed individuals may experience eye tearing, redness, and discomfort.

Information on toxicological effects

Acute toxicity Processing may generate hazardous fumes and dusts. Welding, cutting and metalizing can generate ozone. Ozone can cause irritation of eyes, nose and respiratory tract. High concentrations of freshly-formed fumes of zinc oxide can produce symptoms of metal fume fever.

Components	Species	Test Results
Iron (CAS 7439-89-6)		
Acute		
Inhalation		
LC50	Rat	250 mg/m3, 6 hours, (Carbonyl iron)
Oral		
LD50	Rat	7500 mg/kg
Silicon (CAS 7440-21-3)		
Acute		
Inhalation		
LC50	Rat	> 2.08 mg/l, 4 hours
Oral		
LD50	Rat	3160 mg/kg

Skin corrosion/irritation	Dust may irritate skin.
Serious eye damage/eye irritation	Dust may irritate the eyes.

Respiratory or skin sensitization

Respiratory sensitization	Not relevant, due to the form of the product. Contains nickel: May cause allergy or asthma symptoms or breathing difficulties if inhaled. This ingredient is bound within the product and release is not expected under normal condition.
Skin sensitization	Contains nickel: May cause an allergic skin reaction. Mineral oil: Prolonged or repeated contact with skin may cause redness, itching, irritation, eczema/chapping and oil acne.
Germ cell mutagenicity	Not relevant, due to the form of the product. May liberate hazardous vanadium pentoxide at temperatures above the melting point. Vanadium pentoxide is classified as suspected of causing genetic defects. This ingredient is bound within the product and release is not expected under normal condition.

Carcinogenicity

Not relevant, due to the form of the product. May liberate hazardous oxides such as iron oxides and vanadium pentoxide at temperatures above the melting point. Inhalation of high concentrations of iron oxide may possibly enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Vanadium pentoxide is classified as possibly carcinogenic to humans (Group 2B) by IARC. A residual chrome VI compound from the surface coating is water soluble and is carcinogenic. Chromium VI compounds are regarded as human carcinogens by IARC, NTP, OSHA and ACGIH.
This ingredient is bound within the product and release is not expected under normal condition.

IARC Monographs. Overall Evaluation of Carcinogenicity

Chromium (CAS 7440-47-3)	3 Not classifiable as to carcinogenicity to humans.
Iron oxide** (CAS 1309-37-1)	3 Not classifiable as to carcinogenicity to humans.
Nickel (CAS 7440-02-0)	2B Possibly carcinogenic to humans.
Vanadium pentoxide** (CAS 1314-62-1)	2B Possibly carcinogenic to humans.

NTP Report on Carcinogens

Nickel (CAS 7440-02-0)	Reasonably Anticipated to be a Human Carcinogen.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity

Not relevant, due to the form of the product. May liberate hazardous vanadium pentoxide at temperatures above the melting point. Vanadium pentoxide is classified as suspected of damaging fertility or the unborn child.
This ingredient is bound within the product and release is not expected under normal condition.

Specific target organ toxicity - single exposure

No data available.

Specific target organ toxicity - repeated exposure

Not relevant, due to the form of the product. Contains Maganese: Causes damage to organs (lung) through prolonged or repeated exposure by inhalation. This ingredient is bound within the product and release is not expected under normal condition.

Aspiration hazard

Due to the physical form of the product it is not an aspiration hazard.

Chronic effects

Frequent inhalation of dust over a long period of time increases the risk of developing asthma, chronic lung diseases, and skin irritation. Chronic inhalation of high concentrations of iron oxide fumes or dust may lead to benign pneumoconiosis (siderosis). Exposure to manganese fume/dust can affect the central nervous system (apathy, drowsiness, weakness and other chronic symptoms such as postural tremors). A residual chrome VI compound from the surface coating is water soluble and is carcinogenic. Chromium VI compounds are regarded as human carcinogens by IARC, NTP, OSHA and ACGIH. Pre-existing skin and respiratory conditions including dermatitis, asthma and chronic lung disease might be aggravated by exposure.
The ingredients of the alloy are bound within the product and release is not expected under normal conditions.

12. Ecological information

Ecotoxicity

The environmental hazard of the product is considered to be limited.

Components		Species	Test Results
Zinc oxide** (CAS 1314-13-2)			
Aquatic			
Crustacea	LC50	Water flea (Daphnia magna)	0.098 mg/l, 48 hours

Persistence and degradability

No data available.

Bioaccumulative potential

No data available on bioaccumulation.

Mobility in soil

Not relevant, due to the form of the product.

Other adverse effects

None known.

13. Disposal considerations

Disposal instructions

Dispose waste and residues in accordance with applicable federal, state, and local regulations.

Hazardous waste code

Not regulated.

Waste from residues / unused products

Disposal recommendations are based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal. Recover and recycle, if practical.

Contaminated packaging

Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations Under some use conditions, this material may be considered to be hazardous in accordance with OSHA 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Chromium (CAS 7440-47-3)	LISTED
Manganese (CAS 7439-96-5)	LISTED
Nickel (CAS 7440-02-0)	LISTED
Vanadium pentoxide** (CAS 1314-62-1)	LISTED
Zinc oxide** (CAS 1314-13-2)	LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Chemical name	CAS number	Reportable quantity	Threshold planning quantity	Threshold planning quantity, lower value	Threshold planning quantity, upper value
Vanadium pentoxide**	1314-62-1	1000		100 lbs	10000 lbs

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Manganese	7439-96-5	0-2
Chromium	7440-47-3	0-1
Nickel	7440-02-0	0-0.4

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Chromium (CAS 7440-47-3)
Manganese (CAS 7439-96-5)
Nickel (CAS 7440-02-0)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations WARNING: This product contains chemical(s) known to the State of California to cause cancer.

US. Massachusetts RTK - Substance List

Chromium (CAS 7440-47-3)
Iron oxide** (CAS 1309-37-1)
Manganese (CAS 7439-96-5)

Nickel (CAS 7440-02-0)
Silicon (CAS 7440-21-3)
Vanadium (CAS 7440-62-2)
Vanadium pentoxide** (CAS 1314-62-1)
Zinc oxide** (CAS 1314-13-2)

US. New Jersey Worker and Community Right-to-Know Act

Chromium (CAS 7440-47-3)
Iron oxide** (CAS 1309-37-1)
Manganese (CAS 7439-96-5)
Nickel (CAS 7440-02-0)
Silicon (CAS 7440-21-3)
Vanadium (CAS 7440-62-2)
Vanadium pentoxide** (CAS 1314-62-1)
Zinc oxide** (CAS 1314-13-2)

US. Pennsylvania Worker and Community Right-to-Know Law

Chromium (CAS 7440-47-3)
Iron oxide** (CAS 1309-37-1)
Manganese (CAS 7439-96-5)
Nickel (CAS 7440-02-0)
Silicon (CAS 7440-21-3)
Vanadium (CAS 7440-62-2)
Vanadium pentoxide** (CAS 1314-62-1)
Zinc oxide** (CAS 1314-13-2)

US. Rhode Island RTK

Chromium (CAS 7440-47-3)
Manganese (CAS 7439-96-5)
Nickel (CAS 7440-02-0)
Vanadium (CAS 7440-62-2)
Vanadium pentoxide** (CAS 1314-62-1)
Zinc oxide** (CAS 1314-13-2)

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Nickel (CAS 7440-02-0)
Vanadium pentoxide** (CAS 1314-62-1)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	13-January-2015
Revision date	-
Version #	01
HMIS® ratings	Health: 0 Flammability: 0 Physical hazard: 0
Disclaimer	This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment. SDS's for specific coatings are available upon request.

Material Handling & Storage Instructions

Purpose of this Bulletin

TrusSteel materials must be handled and stored properly to avoid damage.

Material Receiving and Handling

Inspect all materials immediately upon arrival. Report all damaged material immediately to TrusSteel Customer Service and note all damage on carrier's shipping documents. Always lift long pieces of material from more than one lift point to avoid crimping. Take care when banding - do not crimp or bend material. Do not store other materials on top of TrusSteel materials.

Materials Storage

1. Coils or lifts of galvanized steel material shall be stored in a low moisture environment. Under no circumstances should stored material be allowed to become wet.
2. Formed parts shall receive the same care in storage. Formed parts, when stored in bundles, shall be stored at an incline to promote the drainage of any moisture and to avoid moisture build-up in and on the parts.
3. Storage areas shall have good ventilation. Storage areas that have poor ventilation, and that have the potential for trapping moist air in rising temperatures, can create a 'hot house' effect that can create condensation between the layers of rolled or bundled material. This trapped condensation can have the same effect on stored material as exposing it to direct moisture. We recommend the regular inspection of bundled materials to assure that moisture has not penetrated the bundle.
4. Storage environments shall have ventilation adequate to avoid temperature differentials in excess of 20^{o} F between the stored material and the ambient temperature of the storage area. Environments that allow temperature differentials in excess of 20^{o} F can promote moisture condensation on materials.
5. Cold steel materials shall be allowed to warm properly before storage. The rapid warming of incoming materials (when moved from a cool environment to a warm environment) can create condensation. If incoming galvanized steel feels cold to the touch, allow it to warm slowly in a cool indoor area, away from drafts. When the steel has warmed, it may be transferred to a proper storage area.

These storage instructions must be followed to avoid chalking. Chalking is created by the invasion of moisture between two zinc-coated surfaces that are not allowed to dry in an environment that has adequate air flow. The chalking is created through a chemical reaction between the two surfaces when they are stored in an oxygen-deprived atmosphere.

TrusSteel cannot be held responsible for the improper storage of galvanized steel (which may create chalking) once the material has been delivered to the customer's facility. Please review and adhere to the storage recommendations above to reduce the incidence of chalking in your stored inventory.

Additional Documents

Refer to TrusSteel Design Manual for additional information on material handling and storage.

Revisions

- This bulletin was revised on 8/1/01.
- This bulletin was revised on 10/06/10.

Truss Lateral Restraint

Purpose of this Bulletin

Trusses require lateral ***restraint*** to perform properly. This bulletin outlines the ***restraint*** options available and how they are referenced on the TrusSteel truss design drawings and associated documentation.

The following topics are important considerations regarding lateral ***restraint*** for trusses. These topics are expanded upon in this Technical Bulletin.

- Lateral ***restraint*** can be provided to truss members by ***structural panels***, ***purlins***, a ***bearing restraint***, or other means.
- At a minimum, each end of an individual ***chord segment*** must be laterally restrained.
- ***Purlins*** require some form of anchorage method so the ***restraint*** forces can be distributed to the buildings lateral force resisting system.
- Roof planes covered by ***structural panels*** are typically designed as diaphragms. Diaphragms transfer lateral forces imposed on the building, to other elements of the lateral force resisting system. One such lateral force a diaphragm resists and distributes is the truss member restraint forces.
- If the truss chord ***restraint*** condition is not explicitly stated on the truss design drawing, the assumption is that the member is restrained by ***structural panels.***
- In the absence of other means of ***restraint***, individual purlins must be placed at the start and end of each ***purlin zone***.

Important Documents

- **CFS BCSI, "Cold-Formed Steel Building Component Safety Information – Guide to Good Practice for Handling, Installing, Restraining & Bracing of Cold-Formed Steel Trusses", published by the Cold-Formed Steel Council (CFSC).**
- **TrusSteel Technical Bulletin TB98.07.17 "Truss Handling and Bracing"**
- **TrusSteel Technical Bulletin TB98.09.25 "Uplift Hardware with Attachment Criteria"**

Definitions

- ***Bearing Restraint*** – Trusses sit on bearings which provide vertical support. The bearings may also have the ability to provide lateral support. The trusses are attached to the bearing using various truss-to-bearing connections depending on the bearing support material. Refer to TrusSteel Technical Bulletin TB98.09.25 for more information regarding truss-to-bearing attachments. These attachments have the ability to resist uplift forces as well as lateral forces. These values are outlined on the individual detail. When a truss is attached to a bearing that can provide lateral support, the truss chord can be designed using that attachment point as lateral ***restraint***. Typically, exterior bearings are capable of providing lateral ***restraint***.
- ***Chord Segment*** – An individual section of a truss where the chord forms a single plane. This may be a top chord or a bottom chord and there may be several ***chord segments*** on a truss. At a minimum, each end of an individual ***chord segment*** must be laterally restrained. If properly attached sheathing is used along the entire chord ***segment***, this requirement is satisfied. If ***purlins*** are used, then a properly attached ***purlin*** must be attached to each end of the ***chord segment***.
- ***Purlin*** – This is one method of providing lateral ***restraint*** to a truss member. Typically, ***purlins*** are attached to a truss member in the form of a hat-channel, but can be of any structural shape. If ***purlins*** are used to laterally restrain a truss member, they will be placed perpendicular to the truss member and at specified spacing along the entire length of the member. For truss chords, there may be several ***purlins*** attached along the length. If lateral ***restraint*** is required on truss webs, there may be only one placed in the middle of the web or more than one equally spaced along the member. ***Purlins*** will require some form of anchorage method so the ***restraint*** forces can be distributed to the buildings lateral force resisting system. Refer to TrusSteel Technical Bulletin TB98.07.17 for more information.
- ***Purlin Zone*** – An individual section of a truss that has a specific ***purlin*** spacing.

- ***Restraint*** – The means of providing lateral support to a truss member that restricts the movement of the member out-of-plane of the truss.
- ***Structural Panels*** – Also known as "Sheathing". This is one method of providing lateral ***restraint*** to a truss member. Typically, ***structural panels*** are attached to the truss top chord in the form of structural steel deck or span-rated plywood, but could also be attached to any truss member, if appropriate. These sheathed roof planes are typically designed as diaphragms. Diaphragms transfer lateral forces imposed on the building to other elements of the lateral force resisting system. When properly attached, the ***structural panels*** also laterally restrain the truss member, and then transfer those ***restraint*** forces to the buildings lateral force resisting system.

Information

There are various ways that truss member lateral ***restraint*** assumptions are outlined on the truss design drawings. Items that offer lateral ***restraint*** are ***structural panels, purlins,*** and possibly bearings. It is important to state these assumptions on the drawings, because the truss members are designed using them. Depending on the number of chord segments and the difference of the restraint on each chord, there could be a simple note on the drawing, or there could be a table to outline the assumptions. Listed below are the different ways these ***restraint*** options could show up on the drawings.

- **Chord Restraint: Simple Note** – There will be a note on the truss design drawing stating the ***purlin*** spacing for the chord segments. This note will be displayed only when the ***restraint*** condition is straightforward. An example of this note is shown below:

  In lieu of rigid ceiling use purlins to brace BC @ 48" oc.

  This example represents a truss that has all the top chords restrained by ***structural panels*** and all the bottom chords (BC) restrained by ***purlins*** attached at 48" spacing along its length.
  NOTE: In this situation, the top chord ***restraint*** condition is not noted. If the condition is not explicitly stated, the assumption is that the member is restrained by ***structural panels.***

  Another example of a version of the note is shown below:

  In lieu of structural panels or rigid ceiling use purlins to brace all flat TC @ 48" oc, all BC @ 72" oc.

  This example represents a truss that has at least one flat top chord and that it may or may not have a sloping top chord. For this example, let's say the truss does have a sloping top chord. This note represents all the sloping top chords restrained by ***structural panels***, all the flat top chords (TC) restrained by ***purlins*** attached at 48" spacing along its length, and all the bottom chords (BC) restrained by ***purlins*** attached at 72" spacing along its length.
  NOTE: In this situation, the sloping top chord ***restraint*** condition is not noted. If the condition is not explicitly stated, the assumption is that the member is restrained by ***structural panels.***

- **Chord Restraint: Table** – A table will be shown on the truss design drawing when the ***restraint*** requirements for the chords are not as simple. Each truss ***chord segment*** and ***purlin zone*** will be represented in the table. This table will define the chord type associated with each method of lateral ***restraint***, the start and end location of the zone, and the type of ***restraint*** used for each zone. An example of this table is shown below:

Laterally Restrain Chords as follows:

Chord Type	*Start (ft)*	*End (ft)*	*Restraint*
Sloped TC	*0.00*	*20.00*	*Structural Panels*
Sloped TC	*20.00*	*40.00*	*Structural Panels*
BC	*0.00*	*10.00*	*Purlins at 72”*
BC	*10.00*	*30.00*	*Purlins at 48”*
BC	*30.00*	*40.00*	*Purlins at 72”*

NOTE: Unless restrained by a bearing or structural panels, a purlin is required at each end of all zones shown above.

This example represents a 40’0” truss that has the top chord (TC) restrained by ***structural panels*** and the bottom chord that has three ***purlin zones***. The first zone is from 0’0” to 10’0” and has the bottom chord (BC) restrained by ***purlins*** attached at 72” spacing. The second zone is from 10’0” to 30’0” and has the bottom chord (BC) restrained by ***purlins*** attached at 48” spacing. The third zone is from 30’0” to 40’0” and has the bottom chord (BC) restrained by ***purlins*** attached at 72” spacing.

The note under the table means that some form of ***restraint*** is required at each end of every zone listed. For this example, that means that a ***restraint*** must be provided at 0.00 feet, 10.00 feet, 30.00 feet, and 40.00 feet. As was mentioned earlier, exterior bearings are typically capable of providing lateral ***restraint,*** which satisfies the lateral ***restraint*** requirement at 0.00 feet and 40.00 feet. The locations at 10.00 feet and 30.00 feet can either be restrained by a ***bearing restraint*** or by a discrete ***purlin*** placed at those locations. For the discrete ***purlin*** condition, in addition to the ***purlins*** equally spaced within the zones, there would need to be a ***purlin*** located at 10’0” and 30’0”.

- **Chord Restraint: Bearing** – Truss chords can also be laterally restrained by a bearing that has been defined as being able to provide this ***restraint*** to the chord. This is called a ***bearing restraint***. In this case, the assumption is outlined under the reaction callouts on the truss design drawing. There could be other types of reactions called out on some trusses. An example of this callout is shown below:

R=2000#
U=780#
W=6”
H=8’
Restrained

R is the vertical gravity load reaction, U is the vertical uplift reaction from wind, W is the width of the bearing, H is the elevation of the bearing, and the term “Restrained” means the bearing provides lateral ***restraint*** to the chord at this location. The truss-to-bearing connection as well as the supporting structure shall be capable of providing this ***restraint*** in these situations.

- **Web Restraint** – Truss webs can be laterally restrained by ***purlins***. If a truss web requires a lateral ***restraint***, there will be a note on the truss design drawing. An example of the note is shown below:

(A) Continuous Lateral Restraint (CLR) equally spaced on member.

In this example, the symbol denoted as “(A)” will be shown next to the truss web at the proper location. The truss web will also have a ***purlin*** shown as a hat channel at that location.

Revisions

- **This bulletin was issued on 09/18/17**

Attachment of Mechanical Systems to TrusSteel Trusses

For many projects, mechanical systems such as sprinkler piping must be attached to TrusSteel trusses. The TS049 through TS049L Standard Detail series addresses the installation and use of sprinkler pipe hanger supports, however, there are other aspects of the truss system that must be considered as well. The trusses must be loaded adequately for the mechanical system being applied, and the structural capacity of the trusses must not be diminished due to the attachment of the mechanical system. Below is a list of guidelines that must be followed when attaching mechanical systems to TrusSteel trusses to preserve the structural integrity of the trusses.

- Do not attach, hang, or support mechanical systems from any web members without prior approval from a TrusSteel engineer.
- Attachments to chord members that create holes with a diameter of 1/4" or less are acceptable anywhere in the cross section when the hole spacing is a minimum of 3 times the hole diameter.
- Attachments to chord members that create holes greater than 1/4" up to 7/16" in diameter are acceptable provided the following four requirements are met:
  1. Only one hole is allowed at any given chord cross section.
  2. Hole is to be placed in any portion of the area labeled "**Acceptable Hole Location**" as shown in Figure 1.
  3. Spacing of holes shall be 24" O.C. minimum along length of member.
  4. Holes cannot be located closer than 6" to a panel point.

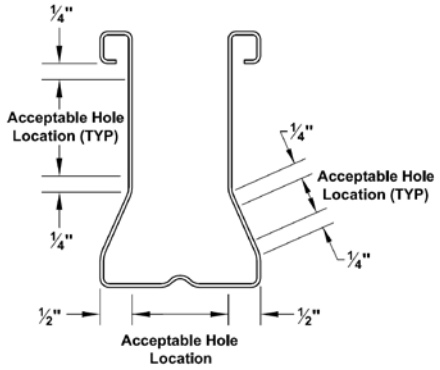

Figure 1

- Attachments to chord members that create holes larger than 7/16" in diameter are not allowed unless approved by a TrusSteel engineer.
- Connectors or hangers attached to only one side of a chord's cross section are allowed provided the supported load does not exceed 100 pounds. No more than (1) one-sided connection is allowed per panel.
- It is preferable to support the hanger concentric with the chord, as in Standard Details TS049 and TS049L, to eliminate eccentric connections.
- The building designer must verify that the building design loads have accounted for the mechanical system loads.

Revisions

- This bulletin was created on 9/20/07.
- Revised 1/18/08
- Revised 3/30/10
- Revised 9/17/13
- Revised 9/23/13

Strongback Bridging Guidelines for TrusSteel Floor Trusses: Commentary for Standard Detail TS066

Overview

Strongbacks are lateral braces that help reduce the dynamic response of a floor framing system by increasing stability. They are not considered structural elements, although they can help distribute the load on a floor truss to the adjacent trusses, helping the floor system to act as a unit.

Strongback guidelines and new Standard Detail TS066

TrusSteel Standard Detail TS066 is provided to designers as a general reference guide for the application of strongback members for TrusSteel Cold-Formed Steel floor trusses only. Specific information on the use and placement of strongbacks for individual project applications is given on the sealed engineering drawings provided by Alpine / TrusSteel as a part of the project shop drawings.

Strongback placement, materials and installation

This information about strongbacks is supplied by notation on the sealed engineering drawings which are provided by Alpine / TrusSteel for each truss project. Below is a typical example of a note:

"(+) 600S162-33 or 550S162-33 stud member continuous strongback. Attach to each truss where shown with (3) #10 SDS into vertical web member."

The locations of the strongbacks are specified pictorially on the sealed engineering drawings and are typically signified with the plus (+) symbol. Members are typically spaced a maximum of 10' O.C. Strongbacks should be located as close to the bottom chord of the floor truss as possible, and should be attached to walls at their outer ends (or restrained by other means). Where strongback members overlap, they should overlap a distance of one truss-to-truss spacing. SDS refers to generic self-tapping metal screws (such as Tek screws).

This information is covered in TrusSteel Standard Detail TS066. In addition, TS066 gives guidance for installing strongbacks when no vertical web is present.

Estimating the amount of material needed

If an estimate for the amount of strongback material is needed, the following procedure can be used as a guide. *Since framing and strongback lengths are different for each situation, only general guidelines are given below.*

1. Print the layout of the floor system.
2. Mark the locations of strongbacks on each floor truss (see sealed engineering drawings or other shop drawings)
3. Draw in the strongbacks (with available material lengths), making sure to account for overlap length (overlap length = one truss-to-truss spacing).
4. Determine total quantity of strongbacks needed.

Additional information

For special situations, or questions not addressed in this Technical Bulletin, contact a TrusSteel engineer.

Included Documents

TS066

Designing with Details TS025B and TS025C

Purpose

Until now, there have been no Standard Details addressing truss to truss connections where vertical and horizontal reactions are present. Standard Details TS025B and TS025C were created to fill this gap, with cantilevered 45º hip corners in mind as a prime use. However, these new details are applicable to any 45º truss condition where the supported trusses have both horizontal and vertical reactions.

Connection Information on Truss Conditions with Vertical and Horizontal Reactions

In the past, customers have received general guidance from TrusSteel engineers similar to Figure 1 below for designing conditions where the supported trusses have both horizontal and vertical reactions.

TRUSS WITH HORIZONTAL AND VERTICAL REACTIONS – SUPPORT ONE END

GIRDER WEB SIZE (Girder Supports Truss with Horizontal Reactions)	MAXIMUM AXIAL FORCE IN GIRDER WEB (LBS.)	MAXIMUM LENGTH OF GIRDER WEB (in.)	MAXIMUM HORIZONTAL REACTION OF SUPPORTED TRUSS (LBS.)
33W.75X.75	N\A	N\A	N\A
33W.75X1.5	542	36	175
33W.75X2.25	850	39	250
33W1.5X1.5	860	56	175
33W1.5X2.0	900	60	280
47W1.5X2.5	1350	60	570
63W1.5X3.5	3550	60	950

•NOTE: There must be an equal and opposite supported truss on both sides of the supporting girder web

Figure 1

Figure 1 is a partial set of information included in Standard Detail drawings TS025B and TS025C, shown in the chart format that TrusSteel engineers have sent out to customers in the past. Using the information given in Figure 1, the truss designer would compare the horizontal reaction on the truss shop drawing to the “Maximum Horizontal Reaction of Supported Truss” column. If the truss horizontal reaction exceeds what is shown in Figure 1, then the chart cannot be used. Likewise, the axial force in the supporting girder web and the length of the supporting girder web cannot exceed the values shown for the sizes shown. As noted in Figure 1, there must be an equal and opposite supported truss on both faces of the supporting girder web. **IMPORTANT** – When using Standard Details TS025B and C, there are other items referenced in the Standard Details, not shown in Figure 1, that need to be checked to determine the adequacy of the designs. For these items refer to TS025B and TS025C.

The information in charts like Figure 1 is very general in nature, and is not connection specific. Depending on the connection designed to attach the supported truss web to the girder web, the values in the above chart are subject to change. Details TS025B and TS025C provide specific information to the truss designer, the truss manufacturer and the truss installer by calling out the connection required and the corresponding design values for that connection.

Important Factors Regarding the Use of TS025B and TS025C

When using Standard Details TS025B and TS025C, the following limitations must be understood.

1. The placement of the girder web is specified in the Detail. When designing the girder, the truss designer must correctly place the supporting girder web in order for the allowable reactions in the Details and the clip dimensions given in Table 1 of this Technical Bulletin to be applicable. The concentrated load from the supported trusses must also be applied in line with the correctly placed girder web in truss analysis.
2. There must be identical supported trusses on both faces of the supporting girder web.
3. The screws applied to the exterior clips (on the supported truss webs) may NOT be placed further than 1.00" from the interior edge of the supported truss. This limit is detailed on TS025B and TS025C. (For 1.5"X1.5" supported truss webs, this is not an issue, so regular end, edge and spacing distances apply.)
4. Two clip pairs are required for all connections. Clip pairs may not be placed further than 6 ¾" away from TSC4.00 girder chords or 5 ¼" away from TSC2.75 girder chords. This distance is measured from the open edge of the girder chords to the closest edge of the clip pairs, and is detailed on TS025B and TS025C.
5. The 33W.75X.75 is **NOT** acceptable to be used for the girder web.
6. Clip dimensions are specific for each supported truss web to girder web connection. These dimensions are given in Table 1 of the next section entitled "Utilization of Details TS025B and TS025C".
7. The truss designer must verify that not only do the vertical and horizontal reactions of the supported trusses comply with the values given in the Details, but also that the axial force in the supporting girder web and the length of the supporting girder web does not exceed the values given in the Details.

Utilization of Standard Details TS025B and TS025C

Both Details use two pairs of 16 gauge ASTM A653 SS Grade 50 Class 1 G60 steel plates to connect the supported trusses to the supporting girder web at 45º. The height of all clips is 3.5", as shown in Figure 2. TS025B is to be used for the connection of supported trusses to TSC2.75 girders, while TS025C is to be used for the connection of supported trusses to TSC4.00 girders.

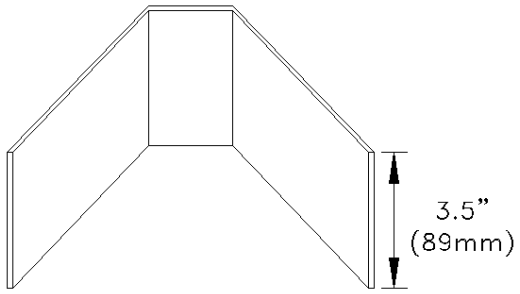

Figure 2

Each clip pair is comprised of an "interior clip" and an "exterior clip", as shown in Figure 3. The interior clip connects the girder web to the inside faces of the supported trusses, while the exterior clip connects the girder web to the outside faces of the supported trusses.

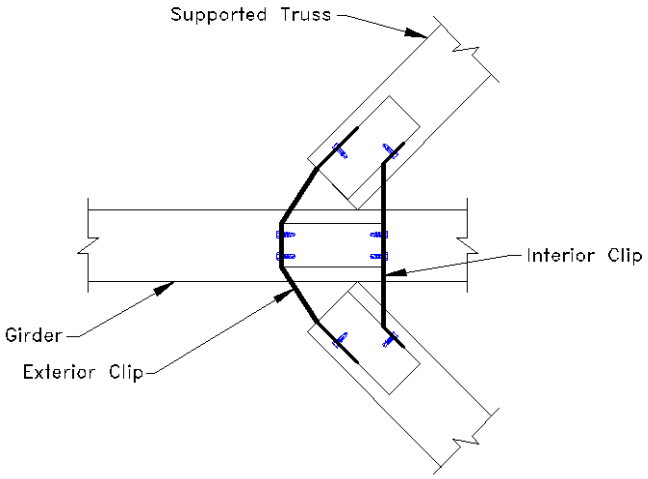

Figure 3

For each supported truss web to girder web combination, the corresponding clip shapes and dimensions are unique. For all possible connections, each clip will be one of the 3 basic shape types shown below in Figure 4; “Type A”, “Type B”, or “Type C”. Although all the clips will conform to one of these basic shapes, the dimensions “L1”, “L2”, “L3”, and the angles “A” and “B” will vary for each different connection.

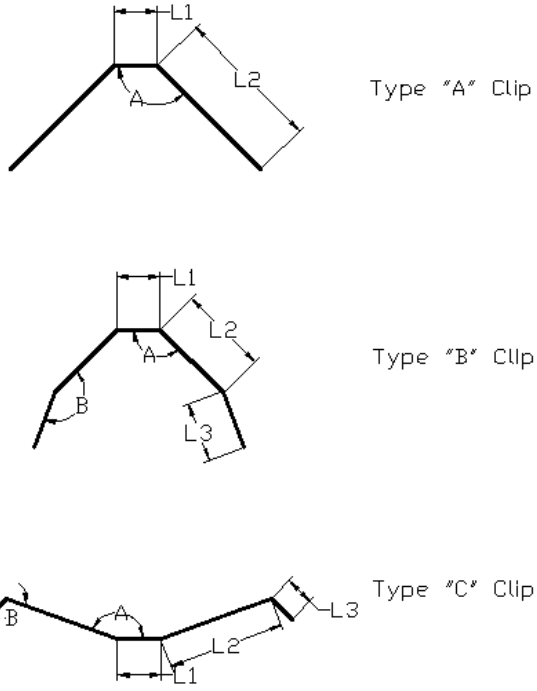

Figure 4

Table 1 gives a listing of all possible supported truss web to girder web combinations with corresponding clip shape types and specific dimensions for both the interior and the exterior clips. Keep in mind that the 33W.75X.75 is not acceptable for the girder web.

Table 1. Clip Shapes and Dimensions for TS025B and TS025C Connections

		Exterior Clip						Interior Clip					
Girder Web	Supported Truss Web	Type	L1 (in)	L2 (in)	L3 (in)	A (º)	B (º)	Type	L1 (in)	L2 (in)	L3 (in)	A (º)	B (º)
33W.75x1.5	33W.75x1.5	B	3/4	1 1/4	1 5/8	158	158	A	3	1	N/A	135	N/A
	33W.75x2.25	B	3/4	1 1/4	1 5/8	158	158	A	3	1	N/A	135	N/A
	33W1.5x1.5	B	3/4	1 3/4	1 5/8	173	142	A	2 5/8	1	N/A	135	N/A
	33W1.5x2.0	B	3/4	1 3/4	1 5/8	173	142	A	2 5/8	1	N/A	135	N/A
	33W1.5x2.5	B	3/4	1 3/4	1 5/8	173	142	A	2 5/8	1	N/A	135	N/A
	33W1.5x3.5	B	3/4	1 3/4	1 5/8	173	142	A	2 5/8	1	N/A	135	N/A
33W.75x2.25	33W.75x1.5	A	3/4	3	N/A	144	N/A	C	3/4	1 1/4	1	164	119
	33W.75x2.25	A	3/4	3	N/A	144	N/A	A	3 3/4	1	N/A	135	N/A
	33W1.5x1.5	B	3/4	1 7/8	1 5/8	162	153	A	3 3/8	7/8	N/A	135	N/A
	33W1.5x2.0	B	3/4	1 7/8	1 5/8	162	153	A	3 3/8	1	N/A	135	N/A
	33W1.5x2.5	B	3/4	1 7/8	1 5/8	162	153	A	3 3/8	1	N/A	135	N/A
	33W1.5x3.5	B	3/4	1 7/8	1 5/8	162	153	A	3 3/8	1	N/A	135	N/A
33W1.5x1.5	33W.75x1.5	B	1 1/2	1 3/8	1 5/8	159	156	A	4	1	N/A	135	N/A
	33W.75x2.25	B	1 1/2	1 3/8	1 5/8	159	156	A	4	1	N/A	135	N/A
	33W1.5x1.5	B	1 1/2	1 7/8	1 5/8	173	142	A	3 5/8	1	N/A	135	N/A
	33W1.5x2.0	B	1 1/2	1 7/8	1 5/8	173	142	A	3 5/8	1	N/A	135	N/A
	33W1.5x2.5	B	1 1/2	1 7/8	1 5/8	173	142	A	3 5/8	1	N/A	135	N/A
	33W1.5x3.5	B	1 1/2	1 7/8	1 5/8	173	142	A	3 5/8	1	N/A	135	N/A
33W1.5x2.0	33W.75x1.5	B	1 1/2	1 1/2	1 5/8	150	165	C	1 1/2	1 1/4	1	171	126
	33W.75x2.25	B	1 1/2	1 1/2	1 5/8	150	165	A	4 1/2	1	N/A	135	N/A
	33W1.5x1.5	B	1 1/2	2	1 5/8	166	149	A	4 1/8	1	N/A	135	N/A
	33W1.5x2.0	B	1 1/2	2	1 5/8	166	149	A	4 1/8	1	N/A	135	N/A
	33W1.5x2.5	B	1 1/2	2	1 5/8	166	149	A	4 1/8	1	N/A	135	N/A
	33W1.5x3.5	B	1 1/2	2	1 5/8	166	149	A	4 1/8	1	N/A	135	N/A
33W1.5x2.5	33W.75x1.5	A	1 1/2	3 1/4	N/A	143	N/A	C	1 1/2	1 3/8	1	161	116
	33W.75x2.25	A	1 1/2	3 1/4	N/A	143	N/A	A	5	1	N/A	135	N/A
	33W1.5x1.5	B	1 1/2	2	1 5/8	159	156	C	1 1/2	1 3/8	1	172	127
	33W1.5x2.0	B	1 1/2	2	1 5/8	159	156	A	4 5/8	1	N/A	135	N/A
	33W1.5x2.5	B	1 1/2	2	1 5/8	159	156	A	4 5/8	1	N/A	135	N/A
	33W1.5x3.5	B	1 1/2	2	1 5/8	159	156	A	4 5/8	1	N/A	135	N/A
33W1.5x3.5	33W.75x1.5	A	1 1/2	3 5/8	N/A	132	N/A	C	1 1/2	1 5/8	1	144	99
	33W.75x2.25	A	1 1/2	3 5/8	N/A	132	N/A	C	1 1/2	1 7/8	1	167	122
	33W1.5x1.5	A	1 1/2	3 7/8	N/A	147	N/A	C	1 1/2	1 1/2	1	154	109
	33W1.5x2.0	A	1 1/2	3 7/8	N/A	147	N/A	C	1 1/2	1 3/4	1	169	124
	33W1.5x2.5	A	1 1/2	3 7/8	N/A	147	N/A	A	5 5/8	1	N/A	135	N/A
	33W1.5x3.5	A	1 1/2	3 7/8	N/A	147	N/A	A	5 5/8	1	N/A	135	N/A

Points to Remember

Details TS025B and TS025C are intended for 45º truss to truss connections with horizontal as well as vertical reactions. There must be identical supported trusses on both faces of the girder, and two clip pairs are required for all connections. In order to use the allowable values given in these Details and the dimensions given in Table 1 of this Technical Bulletin, the girder web must be positioned as specified in the Details. For any special situations not given in these Details or in this Technical Bulletin, please contact a TrusSteel engineer.

Reference Documents

- Standard Details TS025B and TS025C

Revisions

- This Bulletin was originally issued on 04/26/07. It was issued the designation TB06.06.28 in order to coordinate with the Standard Details.

Sheathing Attachment to TrusSteel Members

Purpose of this Bulletin

To identify proper attachment techniques, outline important design considerations, and define design responsibilities that relate to the application of structural sheathing to TrusSteel chords.

Information

Designers should refer to the following standards and informational resources when selecting and designing sheathing and sheathing attachments:

- Recommendations of specific fastener manufacturers
- Recommendations of specific sheathing manufacturers
- The Diaphragm Design Manual published by the Steel Deck Institute (SDI)
- CFSEI Tech Note F101-12 – Screws for Cold-Formed Steel-to-Wood and Wood-to-Cold-Formed Steel Attachments
- CFSEI Tech Note F102-11 – Screw Fastener Selection for Cold-Formed Steel Frame Construction
- CFSEI Tech Note F300-09 – Pneumatically Driven Pins for Wood Based Panel Attachment
- TrusSteel Standard Details TS007, TS008, and TS008A (for the mechanical properties of TrusSteel chords).

There are several types of fasteners and fastening methods available for the structural attachment of sheathing to cold-formed steel framing:

- Pneumatic pins - Suitable for attaching wood based panels (see CFSEI Tech Note F300-09),
- Self drilling screws - Suitable for attaching metal deck, wood based panels, and cementitious panels, and
- Welding - Not a recommended attachment means for metal deck to TrusSteel chords.

For those applications where the attachment of sheathing to cold-formed steel framing is non-structural, the designer should refer to the sheathing manufacturer and job specifications to determine the proper method of attachment.

Application

The designer shall address proper fastener application. Whatever attachment means is selected to attach sheathing to framing, it is important that care is exercised when driving fasteners. DO NOT over torque or overdrive fasteners. DO NOT under drive pneumatic fasteners.

Design Considerations

Structural sheathing typically provides permanent bracing for a truss or framing system and/or acts as a shear diaphragm as part of an overall building design. Design of the sheathing shall include, but not be limited to, the selection of the appropriate sheathing as well as the appropriate type, pattern, and application of fasteners. When designing framing members or the chord of a truss, it is typically assumed that the structural sheathing provides lateral restraint for the member or component. The sheathing shall provide adequate lateral restraint for all affected framing members.

Responsibility

A qualified professional shall verify that the proper fastener has been selected and designed for the appropriate sheathing. The Engineer or Architect of Record shall be responsible for the overall building design, which includes the design of the sheathing as well as the permanent bracing system, by providing either a design or a final review and acceptance of the system.

Referenced Documents

TS007
TS008
TS008A

Revisions

- This bulletin was revised on 1/15/03 to update all standard details attached to this technical bulletin
- This bulletin was revised on 11/8/13 to revise the referenced documents in the Information section

Galvanization Standards

Purpose of this Bulletin

The goal of this Bulletin is to clarify the different galvanization standards as they apply to the corrosion resistance of cold-formed steel framing members.

Information

There are several standards that pertain to coatings on structural members and influence their ability to combat corrosion:

- ASTM A1003
- ASTM A653
- ASTM A792
- ASTM A875
- ANSI/AISI/COFS/ GP 2000
- TrusSteel TB99.11.01

The following coatings are the minimum required by the standards referenced above in order to give corrosion protection for structural or load bearing members:

- G60 (ASTM A653)
- A60 (ASTM A653)
- AZ50 (ASTM A792)
- GF30 (ASTM A875)

In addition to the coatings described above, it may be acceptable to have a different coating as long as that coating has proven to meet or exceed the corrosion protection of the coatings referenced above.

Application

TrusSteel components comply with the corrosion protection requirements set forth in the information outlined above. It is the responsibility of the Engineer or Architect of Record to determine the suitability of any coating in a specific exposure and use.

Included Documents

None.

Revisions

- None.

Multiple Member Trusses

Purpose of this Bulletin

Many truss layouts require at least one multiple member truss. A multiple member truss (sometimes called a multiple ply, multi-ply or girder truss) is a truss assembly that is made up of several single-ply trusses that are attached together, side-by-side, in order to combine their strength. The multiple member truss is most commonly used as a girder truss because of the high loads typically found on these trusses (of course you can and will have single-ply girder trusses).

The *steelVIEW*® software allows the designer to create a multiple member girder truss that is two or three plies wide. And, the TrusSteel® product line provides the truss manufacturer with clips and hangers to connect a tributary truss to a girder truss. Truss web clips (see Standard Detail TS001) or truss hangers (see Standard Detail TS022) are both available to make these connections. The type of connection is usually determined by the allowable load capacity of the connector and the bottom chord size and gauge of the girder truss. Because of the many factors that must be taken into consideration when selecting and sizing these connections, it is important to bear the following information in mind.

Information

Multiple Member Mechanics

A multiple member truss (girder truss) typically supports additional loads from tributary trusses that are framing into the girder. The ability of the girder truss to support these loads depends directly on the strength of all the truss plies acting together. If the plies of the girder truss were not attached to each other, then the first truss (the one that has the tributary trusses framing into it) would support the entire load from the tributary trusses and it would act and deflect independently from the second and/or third ply truss. But, by selecting and applying the correct ply-to-ply connections, you can assure that the plies of the girder act together and evenly distribute loads across all members.

Top and Bottom Chord Bracing

It is imperative that the top chord and bottom chord of any truss be braced in some manner. This is also true for a multiple member truss. Chord bracing can be achieved in a variety of ways, such as structural decking or purlins attached directly to the truss chords. Just as it is vitally important to properly connect together the members of a multiple member truss so that they all act as one member, it is also vitally important that all the chords in a multiple member truss be braced. You cannot just brace one chord and expect the other chords to perform adequately.

If only one of the chord members in a multiple member truss has the sheathing or purlins attached to it, then it is important to attach all of the chords together so they can benefit from the bracing offered by the sheathing or purlins. Ideally, each chord member of a multiple member assembly would have the sheathing or purlins attached to it. For instance, attaching purlins to all three top chords of a three-ply girder would properly brace all members of the top chord. But, frequently it is simply not practical to make (or assure) the connection to all the truss plies to the deck or purlins.

Truss-to-Truss Connections

TrusSteel trusses can be attached to a girder truss with TTC clips (see Standard Detail TS001) or with TSJH hangers (see Standard Detail TS022). When TTC clips are used to connect trusses to a girder, ply-to-ply connections can also be done using TTC clips. The TTC clips will transfer the loads to all members of the multiple member truss when properly applied. But, this technique (see Standard Detail TS001) offers no bracing support for the chords. When hangers are used to support trusses, ply-to-ply connections are made using 14AMDB2.125 screws (for TSC2.75 chords, see Standard Detail TS023) or 14AMD3.5 screws (for TSC4.00 chords, see Standard Detail TS024A). This technique does offer bracing support to the chord that supports the hanger but no bracing support is given to the other chord.

Ply-to-Ply Connections

Now let us bring together all that we have learned in the previous paragraphs. And, we still need to answer two questions:

First, "What do you use for ply-to-ply connections to achieve proper bracing?" The answer is that you ALWAYS use screws to properly brace the chords. Apply the screws as shown in Standard Detail TS023 (for TSC2.75 chords) and TS024A (for TSC4.00 chords). Even if the sheathing (or the purlins) is attached to every chord member, it is good practice to attach all of the chords together in a multiple member truss.

Second, "Where do you position the ply-to-ply connections?" The answer is that you place a ply-to-ply connection wherever a chord brace is required. For instance, if you design a girder truss with purlins on the top chord at 24" OC and purlins on the bottom chord at 48" OC, you should place a ply-to-ply connection at those same intervals along the chords. If you design the chords of a truss with structural sheathing applied, then the ply-to-ply connections should be made at an interval of 12" OC.

If you have a situation where you have trusses framing into the bottom chord of a girder truss and TSJH hangers are used, then care must be taken to follow Standard Detail TS023 (for TSC2.75 chords) or TS024A (for TSC4.00 chords) in order to transfer the loads to the back members. The screws used in these connection details may or may not be adequate to properly brace the bottom chord.

You will need to determine if you have enough ply-to-ply connections to act as bracing. Compare the purlin spacing that you used when you ran the truss in *steelVIEW* with the spacing of the trusses framing to the girder. If the spacing of the trusses is less than the purlin spacing, then the chord will be braced properly as long as you follow TS023 or TS024A. If the spacing of the trusses is more than the purlin spacing, then the chord will not be properly braced if TS023 and TS024A are followed. In order to brace the chord adequately, you must place additional screws in the chord so that the spacing between screws is equal to the purlin spacing.

Application

Creating effective multiple member trusses is really fairly simple, given the support of the Alpine *steelVIEW* software and the Standard Details. But unusual situations do arise, and you may have questions that the Standard Details or this Bulletin does not answer. When this situation occurs, do not hesitate to call your TrusSteel engineer. Have the specifics of your particular design situation at hand when you call to save time for both you and the engineer. You may want to fax or transmit specific details, sketches or truss designs to the engineer before calling in order to expedite your communications.

Referenced Documents

TS001
TS022
TS023
TS024A

Revisions

- This bulletin was revised on 1/15/03 to update all standard details attached to this Technical Bulletin.
- This bulletin was revised on 11/8/13 to correct bulletin number in footer

Sprinkler Pipes – Truss Loading & Connections

Purpose of this Bulletin

Fire sprinkler piping, when supported by trusses, introduces additional loads to the trusses which must be considered during the truss design process. This Technical Bulletin addresses the origin of the minimum sprinkler pipe loads that the structure must be able to resist, what loads the connection must be able to resist, how to calculate them, TrusSteel Standard Details that are available for sprinkler pipe–to-truss connections, and responsibilities for specifying these loads.

Applicable Loads for Structure and for Connection

At the locations of sprinkler pipe connections to trusses, the structure (e.g. the trusses) must be designed to resist different loads than the connection (e.g. the sprinkler pipe hanger). Schedule 40 steel pipe sizes and weights are given in Table A. For other pipe materials, contact the pipe manufacturer for appropriate weights.

Loads for Connection:

Per section 9.1.1.2 (1) of NFPA 13, the connection of the sprinkler pipe to the supporting structure must be able to resist 5 times the weight of the water filled pipe plus 250 lbs. Assuming Schedule 40 steel pipe, and the maximum pipe spacing given in Table 9.2.2.1 of NFPA 13, the minimum load that the connection must be designed to resist can be calculated.

Loads for Structure:

The structure only has to be designed to resist the weight of the water filled pipe plus 250 lbs at each connection per section 9.2.1.3.1 of NFPA 13.

Table A. Sprinkler Pipe Sizes and Weights[1]

Pipe Size (diameter) in	Dry Pipe Weight plf	Wet Pipe Weight plf
1	1.7	2.1
1 1/4	2.3	3
1 1/2	2.7	3.6
2	3.7	5.2
2 1/2	5.8	7.9
3	7.6	10.8
3 1/2	9.2	13.5
4	10.9	16.4
5	14.8	23.5
6	19.2	31.7
8	28.6	50.8
10	40.5	74.6

1. Weights assume Schedule 40 steel pipe.
2. Dry pipe weights do not include weight of water.
3. Wet pipe weights are weights of the water filled pipe.

Calculating Sprinkler Pipe Loads for Structure and Connection

1. Determine the diameter of the sprinkler pipe.

2. Determine the wet weight, W (plf) of the pipe from Table A for Schedule 40 steel pipe. For other pipe materials, contact the pipe manufacturer for wet weights.

3. Determine the spacing, S (ft) for the pipe supports. Maximum spacing is given in Tables 9.2.2.1 in NFPA 13. In general, for schedule 40 steel pipe up to and including 1¼" diameter, maximum sprinkler pipe hanger spacing is 12'0". For pipe diameters larger than 1¼", maximum sprinkler pipe hanger spacing is 15'0".

4. The load, P (lbs) that must be applied to the structure is calculated as follows:

$$P = (WxS) + 250$$

5. The load, R (lbs) that the connection must be able to resist is calculated as follows:

$$R = [5x(WxS)] + 250$$

TrusSteel Pipe Connection Details

Sprinkler pipes must be properly supported from the trusses. Table B shows TrusSteel Standard Details that are available to properly support sprinkler pipes.

Table B. TrusSteel Standard Detail for Sprinkler Pipe Connection to Trusses

Maximum Pipe Size (diameter) in	Connection Location and Description	TrusSteel Standard Detail
8	Bottom Chord (steel angles)	TS049
1 1/2	Top Chord (steel angles)	TS049A
8	Top Chord (steel angles)	TS049B
2	Bottom Chord (C- Stud trapeze)	TS049C
2	Bottom Chord (TSC trapeze)	TS049D
2	Top Chord (C-stud trapeze)	TS049E
2	Top Chord (TSC trapeze)	TS049F
5	Bottom Chord (Double C-Stud trapeze)	TS049G
5	Top Chord (Double C-Stud trapeze)	TS049H
8	Bottom Chord (Double C-Stud trapeze)	TS049I
6	TSC2.75 Top Chord (Double C-Stud trapeze)	TS049J
8	TSC4.00 Top Chord (Double C-Stud trapeze)	TS049K
4	Bottom Chord (Sammys XP-35)	TS049L

Responsibility

It is the responsibility of the Building Designer to review and accept any sprinkler pipe loads, and their connection methods, that are to be applied to the trusses. The Building Designer may specify an additional uniform dead load to be applied to the truss designs to cover the sprinkler pipe loading for the structure in lieu of point loads. In this case, the Building Designer must make it clear in the construction documents that the uniform dead load applied to the structure includes the sprinkler pipe load per section 9.2.1.3.1 of NFPA 13 as outlined above.

Referenced Documents

TrusSteel Standard Details:

TS049	TS049E	TS049J
TS049A	TS049F	TS049K
TS049B	TS049G	TS049L
TS049C	TS049H	
TS049D	TS049I	

Other Documents:

NFPA 13, Standard for the Installation of Sprinkler Systems, National Fire Protection Association (NFPA), 2010

Revisions

- 2/01/01 to add responsibility disclaimer.
- 1/10/02 to add section on pipe connections.
- 1/15/03 to update all standard details attached to this technical bulletin.
- 3/09/11 to revise entire bulletin referencing the most up to date codes, Standards, and Standard Details. Revised entire body of document and Tables A and B.
- 3/10/11 to fix minor grammatical error