



ACE Global Engineering Network
Metalworking Industry

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Occupancy & Processes

Metals are shaped by processes such as casting, forging, forming, rolling, extrusion, sintering, metalworking, machining and fabrication. With sintering, a powdered metal is compressed into a die at high temperature.

Metal fabrication

This is a value-added process that involves the construction/alteration of machines and structures from various raw materials to produce a component part of an end product or an end product.

Typical raw materials used by metal fabricators include:

- Plate, formed, sectional and expanded metals
- Tube and square pieces
- Welding wire, hardware, castings and fittings.

One of the first fabrication processes involves cutting the raw materials to size. A variety of methods are used, the most common of which is by shearing - using mechanical band saws with hardened blades or foot/mechanically powered squares or power shears or guillotines, where a moving blade comes down across a fixed blade to shear the material. Alternatively, cutting torches can be used to cut large steel sections. Typically undertaken on CNC (Computer Numerical Controlled) (usually natural gas powered) 'burn tables', plasma, laser and water jet cutters are also commonly used. Fabrication of structural steel by plasma or laser cutting can also include robots which orientate the cutting head in three dimensions around the material to be cut. Some of the more expensive 'burn tables' also include CNC punching capability, using a carousel of different punches and taps to create the required shape. Alternatively, punch/stamping presses can be used to push a punch/stamp through a material into a die to create a hole in the work piece.

Forming or bending

Typically undertaken on hydraulic, wing or hand brake presses, with 'V' dies used to press the cut metal a pre-determined distance to bend the plate to the desired angle. Specially shaped dies and mandrels are often used to bend tubular sections; rolling machines are used to form plate steel into round sections (a billet is passed through successively narrower rollers to create a sheet); spin forming machines are used to form symmetrical parts; whilst wheeling machines are used to form complex double curved shapes from sheet metal.

Metal fabrication workshops will also normally have a machining capability including lathes, mills, drills, grinders/sanders, polishers/buffers etc., together with other associated portable metal working tools to cut the cold metal to shape.

Eventually, the formed and machined parts will be assembled, possibly by initial tack welding, before final welding. After the weld joint has cooled it is generally sand or shot blasted, primed and painted. Any additional manufacturing or alterations specified by the customer are then completed, before inspection and despatch.

Many fabrication workshops also have some specialised processes – in addition to the above – which they have developed to meet customer needs. These may include, for example:

- Drawing
- Hydro-forming
- Heat treatment
- Casting
- Forging
- Welding/cutting
- Electrical discharge machining or spark eroding
- powder coating
- Wet paint spraying
- Other surface treatment/coating techniques
- Cleaning fluids
- Plastic fabrication, timber fabrication etc.

Note: There are 'special hazards' involving brazing, soldering, extrusion (e.g. warm/hot, cold, hydrostatic).

Drawing

Essentially uses tensile forces to stretch sheet metal (e.g. production of sinks and cans), wire, bar and tube, and is normally undertaken as a cold process. For wire, bar and tube drawing the starting stock is drawn through a die to reduce its diameter and increase its length.

Hydro-forming

Forces metal into a mould under pressure.

Occupancy Overview

Occupancy	Description	ICC	NAICS	*US SIC Major Divisions & Groups	Class
Fabricated structural metal products including: structural metals, joints, structural steel, towers, metal doors, sash, frames and mouldings, fabricated plate work (boiler shops), bins, cable trays, vessels, sheet metal work, ornamental metal work, pre-fabricated metal buildings	With significant use of painting or plastics	3440	332313	D - 34	6
Fabricated structural metal products as above	With no significant use of painting or plastics	3440	332313	D - 34	8
Fabricated structural metal products as above	With significant painting or spraying included	3430	332313	D - 34	6
Fabricated structural metal products as above	With no significant painting or spraying included	3430	332313	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Cutlery, hand tools and general hardware (brackets, castors, etc.), including significant painting or spraying	3421	332214	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Cutlery, hand tools and general hardware (brackets, castors, etc.), with no significant painting or spraying	3421	332214	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Metal cans and shipping containers (cans, barrels and drums)	3411	332439	D - 34	7
Fabricated metal products (except machinery and transportation equipment)	Metal forgings or stampings (caps, crowns, enamelware, kitchen utensils) with significant painting spraying or plastics involved	3460	332214	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Metal forgings or stampings (caps, crowns, enamelware, kitchen utensils) with no significant painting spraying or plastics involved	3460	332214	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Ordinance and accessories (except vehicles & missiles), no explosives	3480	332999	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Screw machine products (bolts, nuts, screws, etc.)	3452	332722	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Miscellaneous fabricated metal products (steel springs, pipe fittings, wire and cable products metal foil and leaf, etc.), with significant painting or spraying included	3490	332999	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Miscellaneous fabricated metal products (steel springs, pipe fittings, wire and cable products metal foil and leaf, etc.) with no significant painting or spraying included	3490	332999	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Wire and cable drawing and/or insulating non-ferrous wire-insulated	3357	331491	D - 34	5

Occupancy	Description	ICC	NAICS	*US SIC Major Divisions & Groups	Class
Fabricated metal products (except machinery and transportation equipment)	Wire and cable drawing and/or insulating non-ferrous wire non- insulated	3357	331491	D - 34	7
Fabricated metal products (except machinery and transportation equipment)	Wire & cable – other and wire products (excluding drawing and/or insulating non-ferrous wire)	3496	331491	D - 34	7
Fabricated metal products (except machinery and transportation equipment)	Metal goods manufacturing – machine shops with large quantities of flammable liquids used	3499	332710	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Metal goods manufacturing – machine shops with small quantities of flammable liquids used	3499	332710	D - 34	8
Fabricated metal products (except machinery and transportation equipment)	Metal goods manufacturing – N.O.C., with significant painting spraying or plastics involved	3499	332999	D - 34	6
Fabricated metal products (except machinery and transportation equipment)	Metal goods manufacturing – N.O.C. with no significant painting spraying or plastics involved	3499	332999	D - 34	8
Coating, engraving and allied services	Plating, polishing, anodizing, enamelling, lacquering, etching and painting (dipping)	3471	332813	D - 34	6
Machinery, except electrical	Construction mining and materials handling machinery and equipment	3531	333924	D - 35	8
Machinery, except electrical	Engines and turbines (steam, gas and hydraulic turbines – generator sets and industrial internal combustion engines)	3511	333618	D - 35	8
General industrial machinery and equipment	Pumps, compressors, industrial patterns (other than wood), industrial process, furnaces and ovens	3561	333913	D - 35	8
General industrial machinery and equipment	Ball bearings, blowers and fans, drives and gear sets, etc. and industrial equipment NOC	3562	333415	D - 35	7
Metalworking machinery and equipment	Machine tools, metal cutting and metal forming, rolling mill machinery and other heavy equipment	3541	333518	D - 35	8
Metalworking machinery and equipment	Tool and die sets, jigs and industrial moulds, machine tool accessories and measuring devices, power hand tools and metal working machinery	3544	333511	D - 35	7
Metalworking machinery and equipment	Office machines, miscellaneous – not electronic (typewriters, calculators, hole punchers, staplers and other office equipment) i.e. mechanical office machines	3579	333313	D - 35	8
Refrigeration and service industry machinery	Vending machines, commercial cleaning equipment, air conditioning, heating and refrigeration Equipment, etc.	3585	333311	D - 35	7

Occupancy	Description	ICC	NAICS	*US SIC Major Divisions & Groups	Class
Refrigeration and service industry machinery	Special industry machinery (except for metal working) for food products, textile, woodworking, paper & printing trade industries, etc.)	3559	333298	D - 35	7
Refrigeration and service industry machinery	Farm machinery and equipment (except tractors, etc.)	3523	333924	D - 35	7
Refrigeration and service industry machinery	– Tractors, combine harvesters and other heavy machinery	3523	333924	D - 35	7
Machinery, except electrical	Miscellaneous machinery (except electrical) amusement machines, machine shops, etc.	3599	333999	D - 35	7

Special Hazards

The majority of special hazards within the metal fabrication sector generally fall into one of five categories, notably:

- The application of heat in one form or another
- The use, handling and storage of combustible oils
- The use, handling and storage of flammable liquids/fluids, gases and oxidising agents
- The use and handling of molten metals
- The use, handling and storage of combustible packaging.

The hazards described below generally involve one or more of these categories:

Brazing

In brazing a filler metal or alloy is heated to melting temperature and distributed between two or more close fitting parts by capillary action. At its liquid temperature, the molten filler metal and flux interacts with the base metal, where it cools to form a sealed joint. There are a number of brazing methods dependent on the needs of the operation. These include: furnace brazing, braze welding and vacuum brazing, exothermic, torch, induction and infrared brazing etc.

Soldering

This differs from brazing in the use of a lower melting-temperature filler metal, and from welding (see below) in that the base metals are not melted during the joining process. It can be undertaken through a production line or via hand tools.

Warm/hot extrusion

Extrusion is undertaken at a high temperature (from 3500c for magnesium up to 20000c for refractory type alloys) to keep the material from hardening and to make it easier to push the material through the die. Most hot extrusions are undertaken on horizontal hydraulic presses under high pressure

Examples of warm/hot extruded metals and their product uses include:

- Aluminium for use in frames, rails, mullions
- Copper for rods, pipe, wire, bars, tubes and welding electrodes
- Lead and tin for pipes wire, tubes and cable sheathing
- Zinc for rods, bar, tubes, hardware components, fitting, and handrails.

Heat treatment

This method is used to alter the physical and sometimes chemical properties of a material. It involves the use of heating or cooling, normally to extreme temperatures, to achieve a desired result, such as hardening or softening of a material.

Heat treatment techniques include:

- **Annealing** used to soften the metal by recovering cold work and relaxing stresses within the metal
- **Tempering and quenching and carburising** – to harden by quenching, a metal (usually steel or cast iron) must be first heated (tempered - controlled reheating of the work piece generally above 1500c) and then quickly cooled, typically with water or combustible oils or sometimes with forced air or other gases, such as nitrogen).
- **Precipitation hardening** is a heat treatment technique used to increase the yield strength of malleable materials, including most structural alloys of magnesium, nickel and titanium, as well as some stainless steels
- **Induction heating** is the process of heating an electrically conducting object (e.g. metals) by electromagnetic induction, where eddy currents are generated within the metal and resistance leads to heating of the metal to harden or as a means of joining metal components. It also allows the targeted heating of a metal item for applications including surface hardening, melting, brazing, soldering and heating to fit.



- Induction hardening is a form of heat treatment in which a metal part is heated by induction heating and then quenched. Examples of induction hardened products include: face hardening of hammers, edge hardening complex shaped tools or the production of small gears, paper and leather knives etc.

Casting

Casting involves pouring (manually or automated) molten metal into a shaped mould to produce the desired part. Virgin and scrap metal is generally heated in electric arc/induction, crucible or gas fired furnaces dependent on the required melt temperatures. Various forms of casting exist in industry including sand casting (using resins and flammable release agents), investment casting (also called the “lost wax process”), die casting and continuous casting. The finished part will generally only require a small amount of machining.

Forging

Forging is hammering a red-hot billet into shape, either on a forging press or manually.

Welding/cutting

Joining or cutting metals can involve the use of highly flammable acetylene or propane in cylinders.

Electrical discharge machining/spark eroding

These are commonly used in engineering facilities to form dies and moulds with complex geometries. The process involves the generation of sparks beneath the surface of a dielectric fluid, which is generally flammable.

Powder coating

This involves a pre-treatment (chemicals/water, sand or shot blasting) of the base metal to remove oil and grease deposits, followed by pre-heating of the metal, before powder coating – using a free-flowing, dry powder (thermosetting polymer or thermoplastic). The coating is typically applied via an electrostatic process, with the object to be painted being charged oppositely from the spray gun, and with the paint from the gun being attracted to the object. The object is then cured (becomes a free flowing plastic) under heat (generally in gas-fired-convection or infrared ovens) to allow it to flow and form a covering of the metal. Other powder coating methods include: electrostatic fluidised bed coating and electrostatic magnetic brush coating.

Wet paint spraying

Using a manual air gun or via an automated process, involving the use of paints and highly flammable liquids, e.g. solvent thinners. The paints and solvents are probably initially mixed in a mixing ‘kitchen’, with the liquids being air pump fed via a manifold to the guns or the automated process.

Other surface treatment/coating techniques include:

- **Electroplating, anodising** – pre-treatment followed by metal deposited on a conductive surface for corrosion resistance, hardness, or for accepting dyes or lubrication. Although the fluids used are mainly non-combustible or flammable, the plating baths can be combustible, whilst heating elements are used.

- **Aqueous non-electrolytic** – typically cleaning, pickling, phosphating, mechanical plating and a variety of other colouring processes, e.g. “blacking” of steel.

- **Galvanizing** – ferrous articles are dipped into molten zinc (or an alloy of zinc) to produce a relatively thick surface layer giving protection against corrosion.

- **Tinning** – ferrous articles are dipped into molten tin (or an alloy of tin) to produce a fairly thick layer of tin (or tin alloy).

- **Metal spraying** – transferring metals by the use of heat, plasma, or arc to the surfaces of prepared components.

- **Vitreous enamelling** – of metallic glass containing liquids by dipping or spraying techniques on to ferrous components e.g. kitchen hobs.

- **Wet etching** – can involve the use of masking tapes, paints, rubbers and plastics, whilst the etch tank can also be heated and may be combustible.

Other ancillary/associated special hazards include:

- **Cleaning and crack detection fluids** – which can be flammable in either aerosol or container format.

- **Plastic fabrication** – often takes place as part of the finishing of an end product (e.g. handles on cutlery/utensils, furniture and tools, plastic sheathing on drawn wire for electrical cables, insulation linings for transportation equipment etc.) This can include a number of processes, involving a heat source, including plastic extrusion and injection moulding, together with the associated plastic granules or waste plastic storage elements that would also be present.

- **Timber fabrication** – using power-driven woodworking machinery, e.g. in timber elements of furniture or packaging crate manufacture.

- **Combustible hydraulic/lubricating oils** – in use in a number of process machines, including horizontal hydraulic presses, with the oils generally operating at very high pressures, and heated quenching tanks on annealing/tempering lines. This often entails bulk-tanked supplies of oils, some of which are pumped systems, whilst there are often numerous drums of oils also present.

- **Combustible packaging** – includes outer timber crates, plastic encapsulation, plastic internal protection/cushioning, cardboard, plastic storage bins etc.

- **Construction materials** – many contain combustible elements (e.g. EPS, PUR, PIR, fibreboard linings, timber roof frames, felt on timber roof coverings, timber stairs and floors etc.), which seriously increase the fire development hazard, particularly if located near to heat-treatment/ignition-source areas.

- **HID lighting** – contains hot gases which can explode if not installed correctly, through impact, scratches on the lamp surface or water contact.

Business Interruption (BI) and Contingent BI considerations

Location

The location of the building (e.g. within a floodplain) could have an impact on recovery. For example, flood waters impacting on heat treatment facilities may cause an explosion or fire, resulting in greater damage to the facility and an extended interruption.

Consider the provision of appropriate flood plans, impact on third-party, neighbouring operations and potential impact on the site itself.

Buildings

Many buildings require high roofs because of the need for specialist overhead cranes. This potentially results in the need for more building materials and extended interruption/increased costs. Deep machinery footings and supports could also result in extending the interruption period because of the need for underground soil sampling and suitability studies.

Local authorities

There could be planning restrictions relating to re-building on site or contingent considerations for any new builds (e.g. use of certain materials/methods of construction etc.), which could extend the interruption period.

Construction materials

Many metalworking buildings contain asbestos within the construction (roofs, wall panels, insulation etc.), which would require specialist removal companies and could extend the interruption period. In addition, combustible elements in many buildings could result in greater fire spread and a longer recovery period.

There is a need to maintain asbestos registers and monitor conditions. Consider introducing long-term a formal removal programme of asbestos and combustible elements used in construction.

Environmental

Sustainable new developments and environmental considerations in any new build or upgrade of partially damaged building could result in an extended interruption period.

Raw materials

The volatility of the metals markets means that an inflated price could severely raise the cost of replacement for machinery, buildings and stock levels. Increased stock levels could also result in potential theft issues, with a knock-on effect on recovery.

Suppliers

In some instances, companies single source their supplies; potentially leaving themselves exposed if the supplier is out of business for any length of time or resulting in increased costs to re-source/replace, pending the revival of their preferred partner.

Consider dual/multi-sourcing.

Tooling, patterns and dies

There is often no special arrangement made for the storage of these. It is vital that drawings and designs are backed-up and regularly removed from the building so that they can be easily re-fabricated.

Consider storage of tools, patterns and dies in separate fire compartmented/detached buildings.

Plant and machinery

There are potentially long lead times in ordering specialist, unique, business critical and bottleneck items.

Consider maintaining copies of drawings/designs etc. off-site or in a separate fire compartmented or detached building on-site.

Utilities

The power, gas, water, air requirements of plant and machinery can often result in long lead times in sourcing and replacing utilities. Both the capacity of the utility companies and the absence of back-up power could result in an interruption in the event of an outage.

Consider the provision of back-up facilities as appropriate.

IT and CAD data

Computer-aided design data and other business-critical data should not be held in same area as originals.

Consider regular, preferably daily, back-up and removal of CAD and any other business critical data from the premises, to aid a quick recovery.

Approvals

Some manufacturing and production techniques may require certain approvals before proceeding, e.g. aerospace/MOD.

Customers

Turnover and profit could be seasonal and any property damage loss during peak periods would have a greater impact than if it were to occur at other times of the year. In addition, there could be over dependencies on a particular group or individual customers and suppliers. Any loss in these cases could result in increased costs, pending a resurgence of their preferred partner. *Consider expanding the customer base.*

Assistance

There may be no group or third-party assistance available for all or part of the operations.

Consider formal third-party agreements.

Emergency/contingency planning

Many companies do not have formal or informal emergency or business continuity plans in place, which could help in immediate post-property damage loss and business recovery activities.

Preparation of formal emergency and contingency plans are essential.





Industry Trends

In recent years nanotechnology has risen to the fore as an engineering solution in the metals industry, with the engineering of metals at the molecular level giving added strength and flexibility.

Companies across the globe are constantly developing new and improved machinery to benefit from the smallest improvements in technology.

There is also the ever-increasing need for complete machining cells and CNC centres, which can eventually result in reduced manufacturing and power requirement costs, lower staffing levels and increased profit. However, this can create over-dependency and potentially extended business-interruption periods.

Demand for metals can rise and fall, dependent on economic conditions and capacity. In 2008, for instance, demand outstripped supply in China and markets rose continuously, in part due to production controls during the Beijing Olympics and re-building following the major earthquake.

In boom times, over consumption of high valued metals, resulting in limited availability and increased value has seen an increase in thefts of specialized alloys. Conversely, the recent global economic down-turn, has produced a drop in demand and prices resulting in potential stockpiling, which also creates increased theft risks and site congestion issues. Tight margins on end products also result in companies looking for savings and efficiencies. A development of the downturn is for companies to outsource their raw-material supplies and take advantage of the production volumes of a specialist, global company to reduce costs through economies of scale.

Prior to the down-turn, many companies kept stocks of raw materials to a minimum, using a just-in-time approach. There is an ongoing need for product development cycles to become shorter to cope with the growing demand for turnkey projects and bundled services. Check I have deleted the right info here.

The emphasis on environmental considerations has led to a need for clean requirements for work places and pressure to reduce residual soiling and disposal, with resultant cost effects. In addition, emissions restrictions require companies to eliminate or control the output of waste liquids, gases, solids and noises, resulting in increased overall manufacturing costs.

Requirements and Recommendations

Suggested minimum protection features and risk management criteria

NFPA or locally internationally recognised standards, codes and regulations should be used for all protections as appropriate.

1. Introduction of formal management-of-change procedures to inform ACE of changes in COPE (Construction Occupancy Protection and Exposure) features, including heating arrangements
2. Formal hot-work permit to work systems for both own and contract staff, including sufficient checks: adequacy of contractors insurances and post-work fire watches
3. Provision of a building-construction materials plan to highlight location of combustible elements in construction (particularly composite combustible panels), to enhance permit to work procedures
4. To prohibit smoking throughout buildings (unless, of course this is already required by law) especially in all areas where combustibles, flammables and other volatile materials or hazards are present
5. Regular and formal self-inspection procedures to include housekeeping within plant-room environments and around heat-treatment areas, which should be kept clear of combustibles, flammables, other volatile materials
6. Regular and formal inspections and checks of fixed and portable electrical systems and equipment, including programmed thermography testing
7. Appropriate management/protections/replacement programmes for HID (High Intensity Discharge) lighting, with guidance being obtained from the separate HID factsheet, as appropriate
8. Planned preventative maintenance (PPM) programmes covering all critical plant integral safety features, e.g. checking of over-temperature cut-out devices, earth bonding, etc.

9. PPM programmes for buildings
10. Formal impairment procedures to any fixed fire-protection measures, fire-compartmented areas and security arrangements
11. Formal monitoring procedures (possible CCTV surveillance/remote alarms) for any machine, containing a heat-treatment/ignition-source element, that runs on extended cycles unattended
12. Provision of suitable combustion trains for heat-treatment equipment, which should include over-temperature cut-outs, RCD protection, flame failure, gas pressure differential isolation etc., as appropriate
13. Provision of automatic isolation on oil/flammable liquids pipe transfer systems, linked to fire protection systems and pressure differential
14. Suitable fire-compartmented storage of any bulk supplies of flammable liquids, aerosols etc.
15. Provision of flammable liquids safety containers with flash arresters for the transfer/decanting of flammables
16. Provision of suitable and appropriate earth bond protection where flammable liquids and gases are being used
17. Suitable fire-compartmented electric switch, pump and other critical plant and control rooms
18. Suitable fire-compartmented areas around bulk storage facilities, containing combustible packaging, containers etc. and as part of the storage of the metal components
19. Suitable segregated storage for oxygen and fuel gas cylinders, together with the provision of flash/spark arrestors and crimped clips for securing hoses when cutting or welding operations taking place
20. Automatic fire detection (smoke/heat as appropriate) in all plant rooms, equipment control rooms, server rooms etc.
21. Provision of localised automatic fire suppression systems, where the special hazard warrants such protection levels, e.g. foam or CO₂ on quench tanks or foam on spark erosion baths
22. Provision of appropriate physical and electronic security measures (e.g. fencing, CCTV, guarding, intruder alarms with dual remote signalling) commensurate with the risk
23. Serious consideration should also be given to the provision of sprinkler protection in all areas of the building, with water supplies sized to cater for the highest fire loading on site
24. An 'adequate' rating, at least, for public or private fire fighting water supplies
25. In addition to the above, there should be full compliance with all relevant local health, safety and environmental legislation.

ACE Inspection Frequency

Please refer to the ACE Fire Underwriting guidelines.

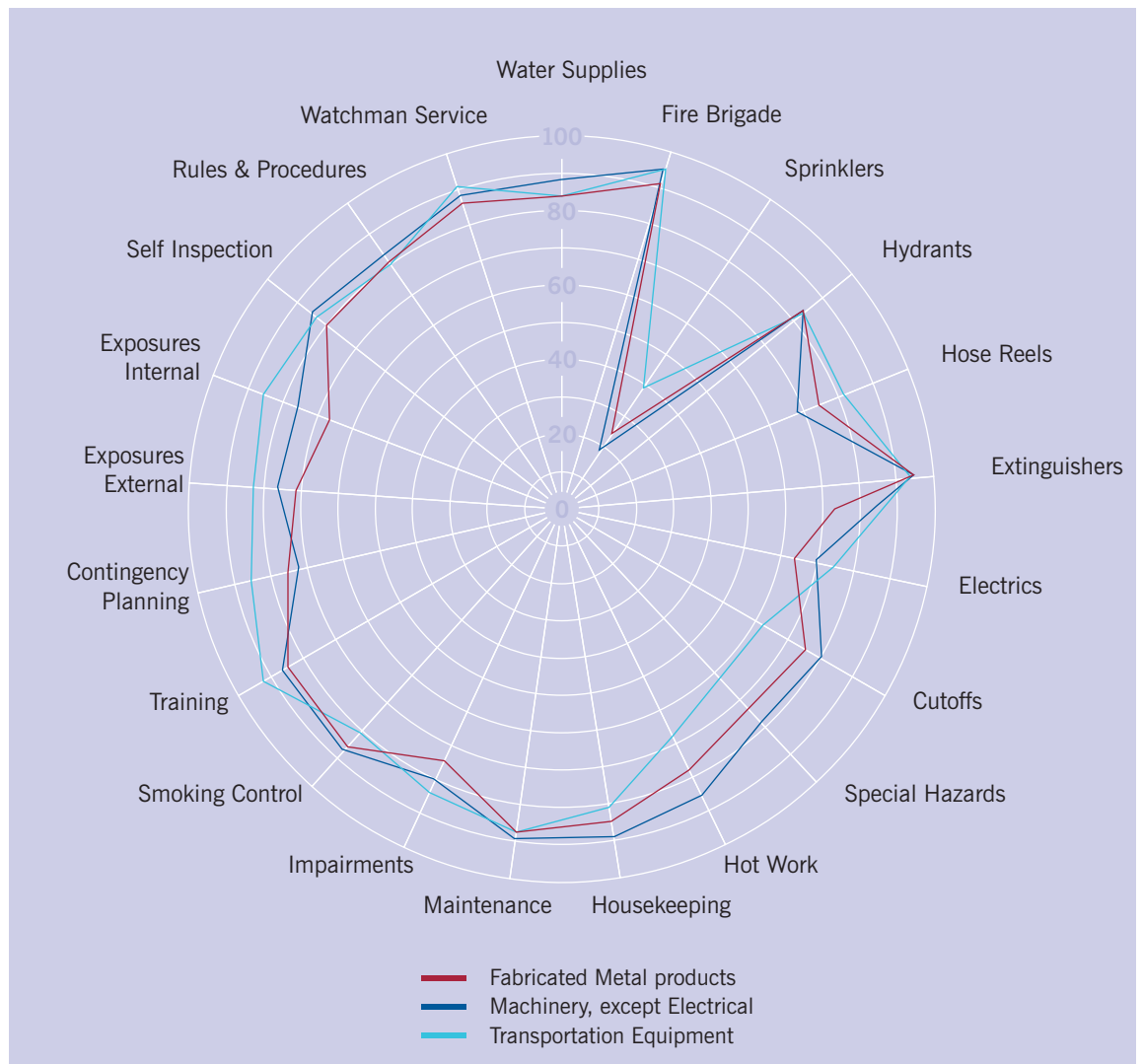
Industry Benchmarking

Outer circle represents best industry practice.

Cranberry line represents the global average of ACE inspected fabricated metal product operations during a period of five years.

Navy line represents the global average of ACE inspected machinery (except electrical) operations during a period of five years.

Aqua line represents the global average of ACE inspected transportation equipment operations during a period of five years.



Loss Experience

ACE Experience

Date	Company	Loss Estimate	Loss
May 2003	FKI (Netherlands)	\$1,500,000	Fire involving generator balancing rig.
October 2004	Firth Rixson (UK)	\$671600	Malicious damage by employee.
September 2005	Firth Rixson (UK)	\$2,190,000	Welding of a noise insulation panel.
October 2008	Doncasters (UK)	\$9,344,000	Electrical fault on immersion heater attached to an acid pickling unit.

Industry Experience

The following extract has been sourced from the UK InFiRes statistics database.

Date range selected: 21/11/2000 to 27/05/2009

Occupations selected: Engineering, metal industry, vehicle manufacturers

Ignition sources selected: Deliberate, electric, electricity supply, explosion, flammable glue, fluid, friction, furnace, gas, heat, heating equipment, hot work, lighting, LPG, natural occurrence, oil, oil/fuel, smoking materials, sparks, spontaneous combustion, spread from secondary fire and static

UK InFiRes statistics database

Source of Ignition	Point of Origin	Time	Occupancy	Country	Town	Date	Total loss sterling value £
Deliberate	Office	04:38	Metal industry	Berkshire	Maidenhead	07/03/2004	310,000 00:00
Deliberate	Office	03:00	Vehicle	West Midlands manufacturer	Birmingham	10/03/2001	90,000 00:00
Deliberate	External structure	01:40	Engineering	Lothian	Bathgate	04/07/2001 and Borders	200,000 00:00
Deliberate	Integral offices on mezzanine floor	20:30	Metal industry	West Midlands	Coseley	29/12/2002 00:00	180,000
Deliberate	Office	00:20	Engineering	West Midlands	Coombs Rd, Halesowen	25/02/2003	200,000 00:00
Electrical fault	Workshop	15:30	Metal industry	Cambridgeshire	Whittlesey	12/02/2004	680,000 00:00
Electrical fault	Office	19:15	Engineering	Strathclyde	Glasgow	02/03/2004	1,260,000 00:00
Electrical fault	Workshop	22:00	Engineering	County Durham	Consett	30/12/2003	480,000 00:00
Electrical fault	Unknown: Location - Other Buildings	06:30	Engineering	Derbyshire	Glossop	01/04/2004 00:00	210,000
Electrical fault in Workshop	Compressor	07:20	Engineering	East Yorkshire	Hull	11/05/2003 00:00	100,000
Electrical fault	Workshop	20:30	Engineering	Essex	Romford	29/04/2004 00:00	130,000
Electrical fault	Office within warehouse	01:52	Engineering	Hampshire	Bordon	01/05/2004 00:00	1,700,000

Source of Ignition	Point of Origin	Time	Occupancy	Country	Town	Date	Total loss sterling value £
Electrical fault	Workshop: Location - Other Buildings	09:30	Engineering	Kent	Southfleet	10/12/2005 00:00	200,000
Electrical fault	Office	15:00	Engineering	Norfolk	Thetford	10/08/2003 00:00	565,000
Electrical fault	Electro-plating room	04:43	Engineering		Blackmarsh Road, Colwyn Bay, Conwy	26/04/2002 00:00	600,000
Electrical fault	Electroplating shop	06:20	Engineering	Hampshire	Portsmouth	05/06/2002 00:00	450,000
Electrical fault	Main Office	08:50	Engineering	Oxfordshire Oxon	Banbury,	26/01/2002 00:00	130,000
Electrical fault on site	Main sub station	00:30	Metal industry	Derbyshire	Burton on Trent	14/06/2002 00:00	160,000
Electrical fault	Workshop	02:30	Engineering	Cheshire	Woolston,	26/10/2002 Warrington	130,000 00:00
Electrical fault	Lathe in factory	17:10	Engineering building	Northants	Kislingbury	22/11/2004 00:00	110,000
Electric space	Workshop heating appliance	10:30	Metal industry	Strathclyde	Wishaw	26/03/2010 01 00:00	208,000
Electric (general)	Tank	13:30	Engineering	Derbyshire	Ikeston	13/05/2001 00:00	2,705,000
Electric (general)	Machine	00:05	Engineering	Cambridgeshire	Huntingdon	19/03/2004 00:00	100,000
Electric (general)	Warehouse	18:25	Transport	Hampshire	Eastleigh	20/01/2002 00:00	275,000
Electric (general)	Workshop	10:00	Metal industry	Dorset	Weymouth	20/03/2001 00:00	1,500,000
Electric (general)	External Structure	22:00	Engineering	Cheshire	Stockport	19/06/2001 00:00	220,000
Electric	Machine	01:30	Engineering	Gloucestershire	Cheltenham	30/03/2004 00:00	125,000
Explosion (general)	Galvanising Tank	07:45	Metal industry	Greater Manchester	Heywood	04/04/2003 00:00	250,000
Fluid	Plating line	04:00	Engineering	Derbyshire	Chesterfield	20/06/2002 00:00	160,000
Fluid	Mould Production Unit	13:00	Metal industry	West Midlands	Birmingham	18/07/2003 00:00	1,200,000
Friction	Tornos Deco CNC sliding headstock Lathe	03:00	Engineering	Worcestershire	Redditch	21/12/2001 00:00	60,000
Friction	Machine	12:35	Engineering	Warwickshire	Rugby	04/07/2003 00:00	140,000
Heat	Waste bin in	11:00	Transport workshop	Norfolk	Great Ellingham, Attleborough	14/01/2003	150,000 00:00
Heat	Power House	06:45	Engineering		Glasgow	24/03/2005	5,000,000 00:00
Hot work (general)	Workshop	13:10	Engineering	Gwynedd	Tywyn	17/07/2003	220,000 00:00
LPG cutting equipment	Workshop	20:45	Engineering	Lancs	Burnley	02/09/2004	695,000 00:00

Source of Ignition	Point of Origin	Time	Occupancy	Country	Town	Date	Total loss sterling value £
Oil (general)	Processing area 00:00	15:00	Metal industry	South Yorkshire	Sheffield	11/12/2004	200,000
Sparks	Workshop	08:30	Transport	Devon	Kingsbridge	01/04/2005	414,000 00:00
Sparks	Manufacturing Press	17:10	Engineering	Lancashire	Accrington	17/12/2001	90,000 00:00
Sparks	Fume extraction cabinet in laboratory	10:45 00:00	Engineering	Lancashire	Blackpool	05/11/2002	130,000
Sparks	Metal spray booth	16:00 00:00	Engineering	Lancashire	Barnoldswick	05/12/2002	250,000
Spread from Secondary fire	Unit 2 Merriott House	03:55 00:00	Engineering	Devon	Exeter	16/12/2002	270,500
Welding Cutting Equipment	Factory Production Room: Location Other Buildings	10:15 00:00	Engineering	Cheshire	Winsford	18/10/2006	150,000

Steel Industry Large Losses 1994 to 2002

Date	Company	Gross Loss Amount	Loss	Comments
April 1994	Weirton Steel Corporation	\$120,000,000	No. 9 Tandem Mill fire	
April 1995	USX Corporation	\$95,000,000	Event over-pressurizing Blast Furnace No.8	Unknown event (Major Slip, or Water Induction) caused over-pressurization of furnace, and the top was blown off the furnace.
April 1996	USX	\$100,000,000	Side-wall breakout in Blast Furnace No.13	Side-wall break-out, which lead to reline of the furnace. This furnace was a large diameter furnace with an annual production of 10,000 tons of iron a day
1996	Worthington Steel	\$80,000,000	Pickle Line Fire	Combustible spray on insulation on the interior of the building, fire was caused by Cutting and Welding.
2000	LTV Aliquippa, PA	\$38,000,000	Cleaning Line Fire	Cutting and Welding near Plastic Tanks. Facility sold to USX and never reopened.
February 1, 1999	Rouge Steel	\$345,000,000	Boiler House Explosion	Resulted in a plant wide shutdown effecting Ford Motor's production.
May 2001	USS/Posco	\$225,000,000	Cold Mill Fire	Hydraulic Leak
Sept 30, 2001	Bethlehem Steel	\$10,000,000		Fire in Storage Area
November 8, 2001	Corus Steel	\$300,000,000	Blast Furnace Break-out	
December 16, 2001	Double Eagle	\$110,000,000	Plating Line Fire	
January 2002	Sumco	\$25,000,000	Plater Fire	

Date	Company	Gross Loss Amount	Loss	Comments
March 24, 2002	Thyssen-Krupp	\$110,000,000	AST Mill	Turin, Italy
Nov 26, 2003	Thyssen-Krupp Steel	\$145,000,000	Cold Mill Fire	Cutting and Welding
Dec 13, 2004	Wheeling Pittsburgh		BOF	Ductwork collapse
August 22, 2005	Bluescope Steel	\$50,000,000	Hot Strip Mill Fire	Electrical Fire
February 2005	Mittal Steel	\$220,000,000	Hot Strip Mill Fire	Kazakhstan – Cable Tray Fire
Sept 14, 2005	Thyssen-Krupp Steel	Unknown	Unknown	Bay Uerdingen
January 5, 2008	Severstal NA	\$600,000,000	Blast Furnace Breakout	18 month restoration

ACE Contacts in your region for further information

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*G – Denotes Global Product Champion

Glossary

Metals can all be classified as either ferrous or non-ferrous.

Ferrous metals

Are those which contain iron, and may have small amounts of other metals or other elements added. This can include pure iron, such as wrought iron, or an alloy such as steel. Ferrous metals are often, but not exclusively magnetic, and have generally little resistance to corrosion. Examples include cast iron (re-melted pig iron with small amounts of scrap steel), mild steel (0.15% to 0.30% carbon content), high and medium carbon steel (0.3% to 1.4% carbon content), and stainless steel (18% chromium and 8% nickel added) which, although corrosion resistant, is still classed as a ferrous due to the iron content.

Non-ferrous metals

Do not contain iron, are not magnetic and are more resistant to corrosion. Examples include aluminium, lead, zinc, tin and copper (pure metals), brass (65% copper and 35% zinc).

Metallurgy

A branch of materials science that studies the physical and chemical behavior of metallic elements, their inter-metallic compounds, and their mixtures, e.g. alloys.

Alloys

A mixture of two or more metals. Most pure metals are either too soft, brittle or chemically reactive for practical use. However, combining different ratios of metals as alloys modifies the properties of pure metals to produce more beneficial characteristics. The aim of making alloys is generally to make them less brittle, harder, corrosion resistant, or have a more beneficial colour and shine. Examples of alloys are steel (mostly iron and carbon content between 0.2% and 2.14%), brass and bronze (copper and tin). Alloys specially designed for highly demanding applications can often contain ten or more elements.

Galvanized steel

Although not an alloy, this is a commonly used steel, which has been hot-dipped or electroplated in zinc for anti-corrosion protection.

Noble metals

Are resistant to corrosion or oxidation and tend also to be classed as precious metals due to their perceived rarity, e.g. gold and silver.

Pure metals

Consist of a single element (one type of atom) in it, (aluminium, lead, zinc, tin, copper, silver and gold).

Shearing (square or power shear or guillotine)

A metalworking process which cuts metal sheets, plates, coils or rods without the formation of chips or the use of burning or melting.

Brazing

A joining process, in which a filler metal or alloy is heated to melting temperature and distributed between two or more close fitting parts by capillary action. At its liquid temperature, the molten filler metal and flux interacts with the base metal, where it cools to form a sealed joint.

CNC

Computer numerical controlled automated machine.

Die

Material shaping device.

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U.S. Census Bureau – www.census.gov.naics
ACE Global Engineering Network – www.aceagen.com



ACE Global Engineering Network

The ACE Global Engineering Network creates strong, long term relationships with clients, focusing on cost effective and proficient solutions to their risk management challenges.

Through in depth loss prevention training backgrounds and industry expertise, ACE engineers are experienced in evaluating a wide variety of risks and complexity of exposures.

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