BIZ360

Settling into manufacturing work in Busan · Ulsan · Gyeongnam

From arrival through your first 90 days, and the basics of the shop floor

For people new to a manufacturing site in Busan, Ulsan or Gyeongnam

Name _____ Company _____

Department · Role _____ Start date _____

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This translation was produced by AI and has not been reviewed by a human. If you spot an error, please tell us at biz360.kr/contact — we will fix it in the next edition. For safety rules, follow the Korean original and on-site instructions.

Contents

About this book

This book gathers the newcomer material from the settling-in guide (LIVE360) and the job training library (OJT) that BIZ360 runs. Job-specific content (machining, welding, quality and 13 more) is in the job editions, currently Korean only. Rules and deadlines are stated as of the issue date; the current version is at biz360.kr.

Rules and deadlines are stated as of the issue date. For safety, on-site instructions and your workplace rules take precedence. This book is not legal advice.

Part 1

Before you come · After you arrive

Moving and paperwork both run on deadlines. This part puts first the things that get harder to fix the longer you leave them.

Moving-in checklist

These have fixed deadlines — residence registration (전입신고) within 14 days, change of residence report (체류지 변경신고) within 15 days. Read only the rows that apply to you.

Getting ready to move (D-30 on)

- [ ] Task confirm-housing (if you live in company housing)
  Translated detail.
  강소기업 통근버스·기숙사 정보 보기 (https://www.biz360.kr/gangso)
- [ ] Task register-check (if you rent)
  Translated detail.
  인터넷등기소 (https://www.iros.go.kr)
- [ ] Task commute-check
  Translated detail.
  기업별 통근버스 정보 (https://www.biz360.kr/gangso)

Moving week (D-7 on)

- [ ] Task register-recheck (if you rent)
  Translated detail.
  인터넷등기소 (https://www.iros.go.kr)
- [ ] Task utility-transfer (if you rent)
  Translated detail.
- [ ] Task dorm-rules (if you live in company housing)
  Translated detail.

Just after arriving (D+1 on)

- [ ] Residence Registration (전입신고) — within 14 days
  You must do this within 14 days from the day you move into your new residence (Resident Registration Act Article 16 (주민등록법 제16조)). You can handle this online through Government24 or by visiting the resident center. Dormitory residents are also subject to this if that place is their actual residence.
  정부24 전입신고 (https://www.gov.kr)
- [ ] Task fixed-date (if you rent)
  Translated detail.

- [ ] Task lease-report (if you rent)
  Contracts where the deposit and monthly rent exceed the reporting standard must be reported within 30 days from the contract date (rental deposit and monthly rent reporting system (전월세신고제)). Eligibility and the standard amount can be checked at the local residents' center or real estate transaction management system.
  부동산거래관리시스템 (https://rtms.molit.go.kr)

- [ ] Change of Residence Notification (체류지 변경신고) — within 15 days (foreign nationals)
  A person who has registered as a foreigner must report a change of residence (체류지 변경신고) within 15 days from the move-in date (Immigration Act, Article 36). This is handled through High Korea Online (하이코리아 온라인) or the Immigration Inspection Office (관할 출입국·외국인청).
  하이코리아 (https://www.hikorea.go.kr)

- [ ] Task first-day-prep
  Translated detail.
  OJT 교육자료 (무료) (https://www.biz360.kr/ojt)

First month settling in

- [ ] Task support-programs
  Translated detail.
  부울경 지원사업 공고 모음 (https://www.biz360.kr/infohub)

- [ ] 90-day settlement check — Recheck of commuting and housing costs
  Translated detail.
  통근버스·기숙사 있는 기업 비교 (https://www.biz360.kr/gangso)

Your first week on site

What to check before day one

By the day before work starts — Three things to check

Before your first day of work, there are three things to confirm with the HR staff.

- [ ] **Whether work clothes and safety shoes are provided** — the items provided vary by company. If provided, inform them of your size in advance; if you need to purchase them yourself, ask if you can wear sneakers that cover your ankles on the first day
- [ ] **Commute bus pickup location and time** — commute buses in the industrial complex area often only stop at a few city bus stops. The most common cause of being late on the first day is a mistake in the pickup location
- [ ] **Gathering place and required documents on the first day** — required documents such as ID, bank account copy, and health certificate vary by company

Whether the company you are joining operates a commute bus or dormitory can be checked in advance on the BIZ360 Small and Medium Enterprise Detail's on-site information. If the information is empty, it is more accurate to confirm directly with the company.

First day — Safety and health education is a legal procedure.

Manufacturing sites have legally mandated safety and health training upon hiring (Occupational Safety and Health Act Article 29 (산업안전보건법 제29조)). The first day's training is not just formal — you must complete this training to be assigned to the worksite.

If terms used in the training (lifting operations (양중), forklift traffic routes (지게차 동선), LOTO (LOTO)) seem unfamiliar, read the terminology guide for the job-specific OJT module in advance to make it easier to follow.

Things Not to Do on the First Day

- Do not walk outside designated pathways — distinguishing forklift traffic routes from pedestrian pathways is the basic rule of on-site safety
- Do not touch buttons on unfamiliar equipment — even if someone tells you to "press it," refusing before training is correct

First Week of Shift – Check the Form First

Even the same "shift work" (교대) varies by company.

Type	Work Method	Physical Burden
Weekly Fixed	Day shift only	Least
2-shift	Weekly and night shifts alternate every week	Sleep rhythm disruption during night shifts
3-shift	Three teams rotate 8-hour shifts	Rhythm readjustment required for each shift cycle

Before joining, check the shift type in job postings or interviews. Companies listed on BIZ360 KOSHA Site Information (강소기업 현장정보) indicate their shift type, allowing comparison based on that value; if it's blank, ask about it first in interviews.

The first week of night shifts is tough for everyone. A verified general principle is "avoid sunlight immediately after work and sleep at a fixed time," and if specific sleep management is needed, refer to the KOSHA (산업안전보건공단) shift worker health management materials.

Things you can ask in the first week

If you save questions in the first week, the second week will be harder. Things you can ask — rather, things you must ask.

1. Reporting order when defects occur (Should the team leader be informed first? Who has the authority to stop the line?)
2. Location for obtaining and returning materials/tools, and return rules
3. Actual operation of meal/break times (There may be differences between regulations and on-site practices)
4. Criteria for overtime and shift allowances appearing on the pay statement

If wages and allowances differ from the notice, don't deduct them yourself. First, check with the HR team based on the employment contract. If the contract and actual payments continue to differ, the official route is consultation with the Ministry of Employment and Labor (1350).

Sources

National Legal Information Center (국가법령정보센터) — Occupational Safety and Health Act (https://www.law.go.kr)
Korea Occupational Safety and Health Agency (안전보건공단, KOSHA) (https://www.kosha.or.kr)
Ministry of Employment and Labor (고용노동부) Customer Service Center (1350) (https://www.moel.go.kr)

Part 2

Your first 90 days

Nothing here is compulsory, but doing it makes the first three months much easier. Two or three items a week is enough.

The 90-day settling-in list

Thirteen weeks from the day you move in or your first day at work. You do not have to follow the order.

Week 1

- ☐ Daily life basics · Walk around the area within 10 minutes — identify the locations of convenience stores, pharmacies, and laundries
  Translated reason.
- ☐ Getting to work · Week task w1-commute-dryrun
  Translated reason.
- ☐ Daily life basics · Week task w1-emergency-contacts
  Translated reason.

Week 2

- ☐ Daily life basics · Week task w2-mart-route
  Translated reason.
- ☐ Looking after yourself · Week task w2-shift-sleep (shop floor)
  Translated reason.
- ☐ Daily life basics · Week task w2-fix-address
  Translated reason.

Week 3

- ☐ Getting to work · Week task w3-commute-alt
  Translated reason.
- ☐ Daily life basics · Week task w3-lunch-map (shop floor)
  Translated reason.
- ☐ People and neighbourhood · Week task w3-first-question (shop floor)
  Translated reason.

Week 4

- ☐ Money habits · Week task w4-fixed-cost
  Translated reason.
- ☐ Money habits · Week task w4-salary-check
  Translated reason.
- ☐ Money habits · Week task w4-support-scan
  Translated reason.

Week 5

- [ ] Money habits · Week task w5-payslip
  If there is a discrepancy, do not delete it yourself. Check with the HR team first. If it is still different, the official channel is the Ministry of Employment and Labor (고용노동부) 1350.
- [ ] Money habits · Week task w5-auto-save
  Translated reason.
- [ ] Daily life basics · Week task w5-treat-yourself
  Translated reason.

Week 6

- [ ] Looking after yourself · Week task w6-move-30
  Translated reason.
- [ ] Looking after yourself · Week task w6-safety-shoes (shop floor)
  Translated reason.
- [ ] Looking after yourself · Week task w6-clinic
  Translated reason.

Week 7

- [ ] People and neighbourhood · Week task w7-neighborhood-place
  Translated reason.
- [ ] People and neighbourhood · Week task w7-local-event
  Translated reason.

Week 8

- [ ] Growing · Week task w8-job-terms
  Translated reason.
- [ ] People and neighbourhood · Week task w8-ask-feedback (shop floor)
  Translated reason.

Week 9

- [ ] Money habits · Week task w9-two-month-money
  Translated reason.
- [ ] Getting to work · Week task w9-commute-cost
  Translated reason.

Week 10

- [ ] People and neighbourhood · Week task w10-out-of-work
  Translated reason.
- [ ] People and neighbourhood · Week task w10-home-call
  Translated reason.

Week 11

- [ ] Growing · Week task w11-skill-note
  Translated reason.
- [ ] Growing · Week task w11-cert-scan
  Translated reason.

Week 12

- [ ] Daily life basics · Week task w12-home-upgrade
  Translated reason.
- [ ] Daily life basics · Week task w12-lease-calendar
  Translated reason.

Week 13

- [ ] Growing · 90-day settlement check — commuting, housing costs, people, work: each in one line of four sections
  Translated reason.
- [ ] Growing · Week task w13-next-90
  Translated reason.

Part 3

Basics of the shop floor

These apply whichever factory you work in. Read the safety part during your first week.

Safety and your rights

Not getting hurt comes first. Getting what you are owed comes next.

Basic Industrial Safety

Safety is not a choice but a duty.

What you will learn

- Understand the basic contents of the Industrial Safety and Health Act
- Wear Personal Protective Equipment (PPE) correctly
- Learn how to deal with dangerous situations

Overview of the Industrial Safety and Health Act

You will learn about workers' rights and obligations, the employer's safety care duties, the procedure for reporting industrial accidents, and the requirements for completing safety and health training.

Why Should You Know the Industrial Safety and Health Act?

Everyone working in a manufacturing site is protected by the Industrial Safety and Health Act (ISHA). This law has been amended many times since its enactment in 1981, and has helped reduce accidents in Korean industrial sites. Even if you're new, there are four key points you must know within your first week of employment.

1. Workers' Four Major Rights

- **Right to Know**: The right to know about chemicals used in the workplace, hazardous machinery, and accident statistics. The company must post MSDS (Material Safety Data Sheet) and results of workplace environment measurements.
- **Right to Participate**: The right to voice opinions through the Industrial Safety and Health Committee and labor-management consultation meetings. Companies with 50 or more employees must hold these meetings once per quarter.
- **Right to Refuse**: The right to refuse work when there is an immediate danger. You will not face any disadvantages for doing so (Article 52 of the ISHA).
- **Right to Health Checkups**: The right to receive general health checkups (once per year) and special health checkups (every 6 months to 1 year when exposed to noise, dust, or organic solvents) at the company's expense.

2. Workers' Obligations

You are not only entitled to rights, but also have the following obligations:

- Complete safety and health training (8 hours upon hiring, 2 hours of monthly regular training)
- Wear personal protective equipment (PPE)
- Follow work procedures during hazardous tasks
- Immediately report accidents or near misses

3. Employer's Duty to Ensure Safety

A company is not only required to pay wages, but also has the **duty to provide a safe working environment** (Article 655 of the Civil Code + Article 5 of the ISHA). If this duty is violated and an accident occurs:

- **Industrial Accident Compensation Insurance** covers the worker's medical expenses and compensation for time off work
- The employer may face criminal penalties (after the implementation of the Major Industrial Accident Penalty Act, imprisonment of more than one year for fatal accidents)
- Safety management costs must be separately allocated (1.5 to 2.5% of the construction cost)

4. Reporting Procedure in Case of Industrial Accident

```
[Accident Occurs]
   ↓
Immediately call 119 and notify the internal safety manager
   ↓
If work stoppage lasts 3 days or more → the company must submit the Industrial Accident Investigation Report to the
Ministry of Employment and Labor within one month
   ↓
In case of death or major accident → mandatory report to the local labor office within 24 hours
   ↓
Submit an industrial accident claim to the Korea Workers' Compensation & Welfare Service (directly by the worker)
```

Definition of Major Industrial Accident (Article 3 of the ISHA Enforcement Decree):

- 1 or more fatalities
- 2 or more workers with injuries requiring care for 3 months or more
- 10 or more workers with occupational diseases at the same time

5. New Employee First Week Checklist

- [ ] Complete 8 hours of safety and health training upon hiring (keep the certificate)
- [ ] Confirm the location of emergency exits, fire extinguishers, and AEDs in the workplace
- [ ] Note down the name and contact information of the responsible safety manager
- [ ] Measure and receive the appropriate size of PPE
- [ ] Locate the internal industrial accident reporting form

Sources: Occupational Safety and Health Act (National Law Information Center) (https://law.go.kr/법령/산업안전보건법) · Korea Occupational Safety and Health Authority (KOSHA) (https://www.kosha.or.kr) · Occupational Safety and Health Authority Workers' Compensation Insurance (https://www.comwel.or.kr)

Types and Wearing Methods of Personal Protective Equipment (PPE)

Learn the correct way to wear and inspect safety helmets, safety shoes, safety goggles, earplugs, dust masks, and safety gloves.

PPE is the Last Line of Defense

Making the work environment itself safe is the best option (engineering controls), but any remaining risks are blocked by **Personal Protective Equipment (PPE)**. Protective equipment is not about "having it" but about "wearing it correctly."

6 Essential PPE Items

1. Hard Hat (Safety Helmet)

- **When**: All work areas where there is a risk of objects falling on the head (shipyards, construction sites, warehouses, factory receiving areas)
- **Wearing Check**:

- Brim facing forward (do not wear it backward) - Chin strap adjustment — should allow two fingers to fit - Adjust the hammock straps inside the helmet

- **Lifespan**: **3 years** from the date of manufacture (discard immediately after impact, also discard if there is cracking, discoloration, or deformation)

2. Safety Shoes

- **Types**:

- **S1**: General work (anti-static, slip-resistant) - **S3**: Toe protection + ankle protection - **S5**: Insulation (electrical work)

- **Inspection**: Check for deformation of the toe cap (steel cap), sole wear, and loose laces

3. Safety Glasses / Face Shield

- **Usage**:

- Safety Glasses: Protection from flying debris and dust (machining, grinding) - Face Shield: Protection from strong impact, chemicals, and heat (welding, grinding, chemical processes)

- **Note**: Regular glasses are not PPE! Wear over-glasses on top of the glasses or purchase prescription safety glasses separately

4. Hearing Protection (Earpieces / Earmuffs)

- **Wearing Criteria**: Work areas with noise **85dB or higher** (hearing loss from long-term exposure)
- **Selection**:

- Earpieces (foam, silicone): Light and inexpensive, NRR 25~33dB - Earmuffs (headphone type): Easy to remove, NRR 22~30dB - **High noise** (110dB+): Wear **both earpieces and earmuffs** together

5. Respiratory Protection (Dust Mask / Gas Mask)

Type	Purpose	Rating
Dust 1st Class (KF80)	General dust	80% filtration
Dust 2nd Class (KF94)	Fine dust, welding fumes	94% filtration
Dust Special Class (KF99)	Asbestos, heavy metals	99% filtration
Gas Mask (Filter Canister)	Organic solvents, acidic gases	Filter canister color varies by gas type

Important: If you have a beard, the mask will not fit tightly → shave before wearing

6. Safety Gloves

- **Material-Specific Use**:

- Cotton gloves: Light work, **absolutely not allowed on rotating machinery** (risk of fingers getting pulled in) - Leather gloves: Welding, heat, sharp materials - Nitrile/Latex: Chemicals, liquids - Insulating gloves: Electrical work (rated for 1000V~36000V)

Wearing Order ABC

```
A — Apparel (work clothes) first
B — Boots (safety shoes) next
C — Crown (hard hat) last
+ Additional PPE depending on the task
```

Daily Inspection Checklist (1 minute before starting work)

- [ ] Hard Hat: No cracks, discoloration, or deformation
- [ ] Safety Shoes: Check for loose laces and sole wear
- [ ] PPE: Check expiration date and cleanliness
- [ ] Fit: Not too big or too small

Common Mistakes

❌ Remove the hard hat because it's hot and work — one head impact can cause a fatal accident ❌ Loosen the laces on the safety shoes for convenience — sole can come off, foot can be injured ❌ Use a disposable mask for a month — filtration performance drops to 90% after one week ❌ Use cotton gloves on rotating machinery — fingers can be sucked in (actual cause of serious injury and death)

Sources: KOSHA Safety and Health Information Center — PPE Guide (https://www.kosha.or.kr/kosha/data/safetyAndHealthGuide.do) · Industrial safety helmet KS certification (Korean Industrial Standard) (https://standard.go.kr)

Risk Awareness Training (KYT)

You practice the 4-round KYT (Kiken Yochi Training) technique, which involves identifying potential hazards before work begins and developing countermeasures.

What is KYT?

KYT(危険予知トレーニング, Kiken Yochi Training) = **"Risk Awareness Training"**. A Japanese accident prevention technique that involves team members identifying risks and deciding on countermeasures 5 to 10 minutes before starting work.

In Korea, many companies implement it as **TBM-KY** (Tool Box Meeting + KY) during daily work meetings in the morning.

KYT 4 Rounds (Most Standard Format)

1st Round: Fact Identification — "What is the situation?"

Look at photos or blueprints of the work and **list only objective facts**. No guesses or evaluations.

Example (Welding work site photo in a shipyard):

- Worker is welding inside a narrow curved block
- Oxygen concentration meter is located near the entrance
- Welding mask is not worn, and the chin strap is facing backward
- Two hoses are lying on the floor
- Hot work permit is not posted

2nd Round: Root Cause Analysis — "What are the risk factors?"

Extract **potential risks** from the facts in Round 1. Use the form of "There is a possibility of ~".

- Oxygen deficiency → Asphyxiation accident
- No welding mask → Corneal burn from intense light

- Hose → Tripping over the hose
- No hot work permit → Procedure violation + Fire risk

3rd Round: Countermeasure Planning — "How can we prevent it?"

Decide on **specific countermeasures** for each risk. Only actionable ones.

Risk	Countermeasure	Responsible
Oxygen deficiency	Confirm oxygen concentration is above 19.5% before starting work, install a ventilation fan at the entrance	Worker themselves
Light burn	Immediately wear welding mask, use a shade #10 or higher	Worker themselves
Tripping over hose	Organize and secure the hose, ensure clear passage	Team leader
No hot work permit	Issue and post the hot work permit before starting work	Safety manager

4th Round: Goal Setting — "What is our action goal today?"

The team creates a **one-line slogan that everyone shouts together**. Keep it short and specific.

> **"Measure oxygen before entering a narrow space — one, two, three!"** ← All team members shout loudly

Why do we shout the slogan?

According to brain science, **the recall rate of information spoken aloud is 35% higher than reading silently** (Hopper, 1976). When facing a risky situation during work, the slogan will come to mind.

TBM-KY Implementation Process (Every morning, 5 minutes)

```
08:55 Start of work meeting
   ↓
Team leader shares today's work content (1 minute)
   ↓
KYT 4 Rounds (3 minutes)
   ↓
Assign roles + slogan chanting (1 minute)
   ↓
09:00 Start of work
```

How Newcomers Can Do KYT Well

1. **Doubt places you often see visually** — Familiarity can make you overlook risks
2. **Ask "Is this risky?" first** — Questions save lives more than silence
3. **Listen to experienced workers' stories** — Past accident or near-miss cases
4. **Create a checklist** — Write down 5 risks in your work area and check them daily

Top 3 Key Risks in KYT by Industry in Gyeonggi, Chungcheong, and Jeolla

- **Shipbuilding/Offshore**: Oxygen deficiency in confined spaces / Falling / Hot work explosion
- **Automotive Parts**: Entanglement in rotating machinery / Not using both hands on press / Foot injury during transportation
- **Construction/Civil Engineering**: Falling / Falling objects / Electric shock
- **Chemical/Materials**: Chemical leakage / Static electricity explosion / Not wearing respiratory protection

Detailed KYT modules for each industry are available in the respective category.

Sources: KOSHA — TBM-KY Activation Manual (https://www.kosha.or.kr/kosha/data/safetyAndHealthGuide.do) · Safety and Health Education Portal (https://www.koshasafety.or.kr)

Basic First Aid

Learn the initial response procedures for burns, scalds, electric shocks, and crush injuries, and how to use an AED.

The Golden 4 Minutes of First Aid

There is a saying that **the first 4 minutes decide life or death** in cases of cardiac arrest or severe bleeding. How a colleague responds before the 119 ambulance arrives can change the outcome. Even new employees must know these four types of accidents.

1. Burn

Classification

Degree	Depth	Symptoms	First Aid
1st	Epidermis	Redness and pain	Cold water for 15–20 minutes
2nd	Dermis	Blisters and severe pain	Do not pop blisters, cover with a towel and go to the hospital immediately
3rd	Subcutaneous tissue	Loss of sensation, blackened skin	Do not remove clothing, call 119

Immediate First Aid

1. **Cold running water** for 15–20 minutes (do not use ice directly — risk of frostbite)
2. Remove watches, rings, and metal items (before swelling)
3. If clothing is stuck to the skin, **do not remove it** — go to the hospital as is
4. For chemical burns (acid or alkali), **rinse with a large amount of water for over 20 minutes**

2. Cut (Laceration)

Based on the Amount of Bleeding

- **Minor bleeding (oozing)**: Apply clean cloth for 5 minutes, disinfect, and apply a bandage
- **Moderate bleeding (dripping)**: Apply pressure + elevate the wound above the heart, call 119 if bleeding doesn't stop after 10 minutes
- **Severe bleeding (flowing like a fountain)**: Possible arterial damage. **Apply direct pressure + call 119**, tourniquet is the last resort

Amputation Accidents (Fingers/Toes)

1. Apply pressure to the bleeding area
2. Place the amputated part on a clean cloth → plastic bag → **float in cold water** (do not touch ice directly)
3. Suturing is possible within 6 hours (time is life)

3. Electric Shock

Absolute Principle: Turn off the power first

⚠️ Do not touch the **electrically shocked person with bare hands** — you may also get shocked. Follow this order:

1. **Turn off the circuit breaker or plug first**
2. If not possible, use a **dry wooden stick or plastic** to separate the patient from the power source
3. Check the patient's consciousness and breathing
4. If no breathing, perform **CPR (Cardiopulmonary Resuscitation)** + call 119

CPR 30:2

```
30 chest compressions (100–120 per minute, depth 5–6 cm)
   ↓
2 breaths
   ↓
Repeat (until the ambulance arrives)
```

4. Crush / Pinch Accidents

When hands or clothing get caught in rotating machinery or presses:

1. **Immediately stop the machine (Emergency Stop)** — all machines have a red emergency stop button
2. Do not **forcibly pull the trapped part** — risk of greater injury
3. If possible, remove it by reversing the machine (call the team leader or maintenance staff)
4. Until 119 and medical staff arrive, **maintain body temperature** and keep the patient conscious

AED (Automated External Defibrillator) Usage

AEDs are installed in most industrial complexes and public facilities in the Gyeonggi and Busan areas. Anyone can use them, and there is legal immunity.

4 Steps

1. **Turn on the AED** — audio instructions begin
2. **Attach the pads** — below the right clavicle + beside the left rib (as shown in the diagram)
3. **Wait for analysis** — instruction: "Step away from the patient." Everyone must stay away from the patient
4. **Shock button** — press the red button when prompted. Immediately restart CPR after the shock

⚠️ **Do not attach pads to wet skin, metal, or medication patches** — risk of burns or electrical dispersion

What to Do After First Aid

- Note the **time and situation of the accident** (needed for hospital diagnosis and workers' compensation application)
- Immediately report to the **safety manager**
- Take **photos of the workplace** (for site preservation)
- Workers' compensation application guide (refer to Module 1: Overview of the Industrial Safety and Health Act)

What to Prepare in Advance Within the Company

- [ ] Post the **emergency contact list** (safety manager, 119, nearby emergency room) in the workplace
- [ ] Check the **location and contents** of the first aid kit (monthly)
- [ ] Ensure all employees know the **location of AEDs**
- [ ] Complete **in-house first aid training** (free KOSHA training available)

Sources: Korea Cardiopulmonary Resuscitation Association — CPR Guide (https://www.kacpr.org) · Emergency Medical Portal (E-gen) (https://www.e-gen.or.kr) · KOSHA First Aid Training (https://www.kosha.or.kr)

Try this on site

- Personal Protective Equipment (PPE) Wear Self-Checklist
- KYT 4-Round Mock Training
- AED Usage Simulation

Fire Prevention and Fire Safety

The initial phase reduces damage by 90%

What you will learn

- You can choose fire extinguishers based on the type of fire.
- Know the evacuation routes

Fire classes

Learn about the classification of A-class (general), B-class (flammable liquids), C-class (electrical), D-class (metal), and K-class (kitchen) fires and the appropriate fire extinguishers for each.

Not All Fires Are the Same

Fires are categorized based on the **burning material**. Using the wrong extinguisher without knowing the category could not only fail to put out the fire but also **make it larger or cause electric shock**. That is why extinguishers have mandatory fire category labels such as "A·B·C" on their bodies.

5 Fire Categories

Grade	Name	Burning Material	On-site Examples	Extinguisher Indicator Color
A-grade	General Fire	Wood, paper, fiber, plastic	Packing boxes, pallets, work clothes	White
B-grade	Flammable Liquid Fire	Oil, paint, thinner, LPG	Cutting oil, cleaning oil, paint	Yellow
C-grade	Electrical Fire	Equipment with electricity	Distribution panel, motor, cable	Blue
D-grade	Metal Fire	Magnesium, aluminum powder	Machining chips (chip), grinding dust	Colorless
K-grade	Kitchen Fire	Edible oil	Cafeteria deep fryer	—

Why Fire Suppression Methods Differ by Grade

- **A-grade** fires respond best to water. Water lowers the temperature enough to extinguish the fire source.
- **Never spray water on B-grade fires.** Oil floats on water, causing the fire to spread in all directions. Use foam or powder to **cover** and block oxygen.
- **Spraying water on C-grade fires causes electric shock.** Use non-conductive CO_2 or powder, and **turn off the circuit breaker** if possible.
- **Water on D-grade fires causes explosions.** Metal powder reacts with water to produce hydrogen. Use specialized metal fire extinguishing agents (D-grade powder) or dry sand.
- **K-grade** fires involve edible oil at temperatures above the flash point, so even if temporarily extinguished, they **reignite**. Use a specialized K-grade extinguisher to create a barrier on the oil surface.

Most Common Extinguishers on Site

ABC dry chemical extinguisher is the standard. It can be used for A, B, and C grades, so it is placed throughout the factory. However, remember that **it cannot be used for D or K grades**.

Machining areas where chips accumulate and cafeterias with deep fryers **must have separate extinguishers**.

Check These Items During Your First Week at Work

- [ ] Location of the nearest extinguisher in your work area (usually within 20m)
- [ ] Fire category label on that extinguisher (A, B, or C)
- [ ] Fire category that could occur in your process (e.g., B-grade if using cutting oil, C-grade if near a distribution panel)

- [ ] Whether the extinguisher pressure gauge needle is within the **green range** (report immediately if red)

Sources: Fire Department — National Disaster Safety Portal Fire Extinguisher Usage (https://www.safekorea.go.kr) · Korea Fire Safety Institute — Fire Safety Education (https://www.kfsi.or.kr) · KOSHA — Fire and Explosion Prevention Materials (https://www.kosha.or.kr)

How to use a fire extinguisher

Practice the three-step method for using powder, CO2, and foam fire extinguishers: pin → nozzle → discharge.

Fire extinguishers are only useful if you know how to use them

No matter how many fire extinguishers are in the factory, if your hands freeze up when a fire breaks out, they are useless. In real fires, the time to extinguish with a fire extinguisher is **within the first 2 minutes**. Memorize the steps so your body remembers them.

Basic 4 Steps — "Safety Pin · Nozzle · Handle · Sweep"

1. **Remove the safety pin** — Do not pull it while holding the handle. **Remove the pin by holding only the pin**, keeping your hand away from the handle.
2. **Aim the nozzle (hose) toward the fire** — Grip the end of the nozzle. If you only lift the body and spray, it will go to the wrong place.
3. **Grip the handle firmly** — If you grip it gently, the agent will not come out.
4. **Sweep left and right like mopping** — **Target the base of the fire (fuel surface), not the flames**. Shooting at the flames will just make the agent fly away.

Precautions by Type

Type	Features	Precautions
Dry Powder (ABC)	Most common, spray time 10~15 seconds	Vision becomes obscured by white — **stand with your back to the escape route** before spraying
CO2 (Carbon Dioxide)	No residue, suitable for electrical rooms and precision equipment	Nozzle is **-78°C** — **frostbite** if held with bare hands. **Risk of suffocation** in enclosed spaces
Foam	Strong against oil fires	**Risk of electric shock** if used on electrical fires

3 Must-Follow Rules

- **Stand with your back to it.** Always face the fire with your back to the entrance/escape route. If you face the fire, your escape route will be blocked.
- **Face the wind.** If outdoors, face the wind so the agent and heat do not reach you.
- **If it does not go out within 2 minutes, give up and evacuate.** The spray time of one fire extinguisher is about 15 seconds. If the flames **rise above your height**, you are already out of the fire extinguisher's range.

Shout "Fire!" First

Many people try to put it out alone and end up being too late. The order is **① Announce loudly → ② Call 119 → ③ Initial suppression**. If there are people around, divide the roles.

> You must **specifically assign someone** like "Person OO, please call 119!" for actual action.

Practical Checklist

- [ ] Checked removing the safety pin without holding the handle
- [ ] Grasped the nozzle end and aimed
- [ ] Swept left and right at the base of the fire

- [ ] Stood with back to the escape route

Sources: Fire Department — Fire Extinguisher Usage Guide (https://www.nfa.go.kr) · Korea Fire Safety and Technology Research Institute — Practical Training on Fire Facilities (https://www.kfsi.or.kr) · KOSHA — Workplace Initial Response Manual (https://www.kosha.or.kr)

Evacuation drills

Confirm the location of emergency exits, evacuation routes, assembly points, and fire emergency contact network.

Smoke Spreads Faster Than Fire

Most fire-related deaths are not caused by burns but by **smoke inhalation**. Smoke spreads at a speed of **vertically 3–5 m, horizontally 0.5–1 m** per second. It moves up stairwells faster than a person can run.

That is why evacuation must begin **immediately upon hearing the alarm**, not **after seeing the fire**.

4 Principles of Evacuation

1. **Crawl low** — Smoke rises, so fresh air remains near the floor. Crawl on your knees to move.
2. **Cover your mouth and nose with a wet cloth** — If none is available, use a sleeve from your clothing. This filters out some toxic gases.
3. **Hold onto a wall and move in one direction** — Smoke obscures visibility. By keeping your hand on a wall, you will reach the exit.
4. **Never use elevators** — Power outages can trap you, and elevator shafts become smoke chimneys. **Use the stairs only**.

Once You Leave, Do Not Return

The most dangerous moment is when you go back to retrieve something you left behind. Anything you left behind must be abandoned.

Confirm Personnel at the Assembly Point

The final step of evacuation is to confirm **"Has everyone evacuated?"** Gather at the assembly point, count personnel by team/section, and if someone is missing, **do not go looking yourself**. Instead, inform the fire department of their location.

Four Things to Confirm on Your First Day

- [ ] **Two nearest emergency exits from your workstation** (There may be one blocked, so confirm two locations)
- [ ] **Location of the assembly point** (Usually the parking lot or open space in front of the main gate)
- [ ] **What the alarm sound is like** (Siren or broadcast)
- [ ] **Emergency contact information** — Contact details of the safety manager and fire safety officer

Common Mistakes

Mistake	Why It's Dangerous
Stacking materials in front of emergency exits	The door may not open when needed — **Fire Safety Act violation, subject to fines**
Leaving fire doors open	Fire doors must remain closed to block smoke. Securing them with a hold-open device renders them useless
Assuming an alarm is a false alarm	Delaying action by thinking "It's probably another false alarm" is dangerous. Leave immediately and check later

> Fire drills are mandatory at least once a year (Fire Safety Act). Do not just go through the motions — **walk your actual route during the drill**.

Sources: Fire Department — Fire Evacuation Guidelines (https://www.nfa.go.kr) · National Disaster Safety Portal — Fire Action Guidelines (https://www.safekorea.go.kr) · Korea Fire Safety and Technology Research Institute — Fire Plan Document Preparation (https://www.kfsi.or.kr)

Try this on site

- Fire Extinguisher Usage Practice
- Check Emergency Evacuation Route

Electrical safety

Electrocution is a moment, the aftermath is a lifetime.

What you will learn

- Know the causes and prevention methods of electric shock accidents
- Familiarize yourself with the electrical work safety rules.

The danger of electric shock

Learn about the risk levels based on the path of electric current through the human body and the amount of current (fatal above 30mA), and the role of grounding.

220V Can Kill Humans

The misunderstanding that "only high voltage is dangerous" is the most dangerous. A significant number of electrocution deaths occur from **common household 220V**. What's important is not the voltage, but **the size of the current flowing through the body and the duration**.

Human Body Effects by Current Amount

Current	What Happens to the Body
1mA	Tingling sensation (perception current)
5mA	Pain, surprise causing hand to be released
10~20mA	Muscle stiffness — **Unable to release hand (inability to let go)**
30mA	Difficulty breathing, dangerous
50mA or more	**Ventricular fibrillation → Death**
100mA	Lethal within seconds

If current exceeds 10mA, you cannot release your hand by yourself. This is why an electrocuted person tightly grips the wire.

Risk Seen Through Ohm's Law

Current(I) = Voltage(V) ÷ Resistance(R)

Dry hand resistance Approximately 5,000Ω → 220V ÷ 5,000 = 44mA (Dangerous) Wet hand resistance Approximately 1,000Ω → 220V ÷ 1,000 = 220mA (Lethal)

> **Sweat or moisture reduces resistance to 1/5, increasing risk 5 times.** This is why electrocution accidents are more common in summer.

The Path of Current Determines Life or Death

- **Hand → Opposite hand**, **Hand → Foot**: Current **passes through the heart**. Most lethal.
- **Hand → Same side foot**: Current bypasses the heart, relatively less dangerous.

That's why during electrical work, the habit of **putting one hand in your pocket (one-hand rule)** exists. Using both hands creates a path that goes through the heart.

Why Grounding Is Important

If insulation on a wire inside equipment is damaged and it touches a metal casing (leakage), the moment a person touches it, **the human body becomes the path for current**.

A grounding wire creates a path for current to flow into **the ground, which has much lower resistance than the human body**. That's why equipment with a broken or disconnected grounding wire is the most dangerous.

Residual Current Device (ELB/RCD)

This is a device that works with grounding. If incoming and outgoing current differ (= current is leaking somewhere), it **cuts off power within 0.03 seconds**. The reason the rated sensitivity current is **30mA** is directly tied to the danger criteria in the table above.

- **Press the test button (TEST) monthly** to confirm normal operation.
- **Never fix or bypass the circuit breaker if it keeps tripping.** This is a signal that there's a leakage.

5 Rules to Follow on Site

- [ ] Do not touch electrical equipment with wet hands
- [ ] Do not use octopus wiring or cables with damaged insulation
- [ ] For portable electric tools, use **grounded plug (3-pin)**
- [ ] Check RCD test button **monthly**
- [ ] If you find an electrocution victim, **never touch them with bare hands**, first **cut off the power** or remove them with a dry wooden or plastic object

Sources: KOSHA — Prevention of Electric Shock Accidents (https://www.kosha.or.kr) · Korea Electric Safety Corporation — Electric Safety Information (https://www.kesco.or.kr) · National Legislative Information Center — Rules on Occupational Safety and Health Standards (Electrical Work) (https://www.law.go.kr)

Safe electrical work

Learn the principle of confirming the circuit breaker is OFF (LOTO), using a voltage tester, wearing insulating gloves and insulating shoes, and prohibiting live-line work.

"It must be off" creates accidents

A typical pattern of electrical accidents is like this. A turns off the circuit breaker and goes to work, but B says, "Why is it off?" and turns it back on. **Confirm power-off with your own eyes and hands.**

5-Step Power-Off Work Procedure

1. **Confirm the circuit before work** — Check if the diagram matches the actual circuit breaker panel label. Labels are often incorrect.
2. **Turn off the circuit breaker + lockout** — Attach your personal lock and tag (LOTO).
3. **Voltage testing — Directly confirm no voltage with a voltage tester.** This step is skipped most often in accidents.
4. **Discharge residual charge** — Capacitors and inverters retain electricity even after power is off. Ground them with a discharge rod.
5. **Short-circuit grounding** — For high-voltage work, ground to prevent unexpected power surges.

Voltage Tester Usage Rules — "3-Step Confirmation"

If the voltage tester itself is faulty, it may give a false "no power" signal. Therefore, always:

1. **Confirm the voltage tester is working** by testing it on a live circuit
2. **Test the circuit to be worked on** → confirm no response
3. Again **confirm the voltage tester is still working** by testing it on a live circuit

Protective Equipment

Protective Equipment	Standards
Insulating gloves	Distinguish low-voltage/high-voltage use, **check for pinholes with air test before use**
Insulating shoes	Check for sole damage and moisture
Insulating suit/face shield	Wear in arc flash risk areas
Insulating tools	Immediately discard if handle insulation is damaged

Insulating gloves must undergo **regular insulation testing every 6 months**.

Live-line work is strictly prohibited

The **Rules on Industrial Safety and Health Standards** mandate **power-off work as a principle**. If live-line work is unavoidable:

- Issue a **work permit** in advance
- **Assign a supervisor** (2-person team, solo work prohibited)
- Install insulating protective gear
- Observe safe approach distances for live-line work

> New employees **must never be assigned live-line work**. If instructed to do so, refuse and inform the safety manager. This is your **right to refuse work** guaranteed by the Labor Safety and Health Act.

Arc Flash — More Dangerous Than Electric Shock

If a short occurs in a distribution panel, an **arc flash of thousands of degrees** occurs instantly. It injures not by electric shock but by **burns and explosive pressure**.

- When operating a distribution panel, **do not stand in front, operate from the side**
- **Prohibit nylon/polyester workwear** — melts and sticks to skin. **Wear cotton or flame-resistant clothing**

Work Completion Procedure

Do not immediately restore power after work is done.

1. Retrieve tools/materials, confirm all workers are clear of power area
2. Remove short-circuit grounding
3. **Only the person who locked it must unlock the lockout device** (others must not unlock it)
4. Notify all concerned parties of power restoration
5. Confirm if anything is abnormal after power restoration

Sources: Korea Occupational Safety and Health Authority — Technical Guidelines for Electrical Work Safety and Health (https://www.kosha.or.kr) · Korea Electric Safety Corporation — Electric Equipment Safety Inspection (https://www.kesco.or.kr) · Ministry of Employment and Labor — Rules on Industrial Safety and Health Standards (https://www.moel.go.kr)

Try this on site

- LOTO Procedure Simulation
- Grounding Resistance Measurement Practical Training

Environmental management basics

Wastewater, Waste, and Air Management

What you will learn

- Understand the basic environmental regulations
- You can sort and dispose of waste.

Overview of environmental regulations

Learn the basics of environmental impact assessments, emission standards, specific harmful water quality substances, and regulations on air pollutants.

Environmental violations do not accept "I didn't know"

Violating environmental laws does not end with fines. It can lead to **suspension of operations, revocation of permits, and criminal penalties**. Particularly, **employees who actually handle discharges** can also be penalized, not just the employer.

3 Major Media in Manufacturing

Air

- **Installation and reporting/permitting of air pollution control facilities** required (e.g., paint booths, dryers, boilers, dust collectors)
- Main targets: dust, nitrogen oxides (NOx), sulfur oxides (SOx), volatile organic compounds (VOCs)
- **Mandatory self-measurement** — semi-annual to monthly, depending on facility type

Water

- Reporting/permitting of wastewater discharge facilities
- **Specific harmful water pollutants** (e.g., copper, lead, chromium, cadmium, cyanide) are heavily regulated. This applies to electroplating and surface treatment industries.
- If discharged water exceeds quality standards → improvement order → suspension of operations

Waste

- Reporting of business site waste dischargers
- **Allbaro electronic transfer document** mandatory

"Discharge Allowance Standards" Vary by Region

Even for the same pollutant, standards differ based on **Clean Zone / General Zone / Non-Zone / Special Zone**. Most industrial complexes in Busan, Ulsan, and Gyeongsangnam-do are in Non-Zones, but areas near water sources are much stricter.

> **Confirm with the environmental officer** exactly which regional standard applies to our factory.

Common Mistakes for New Employees

Action	Why It's a Problem
Discharging washing water into stormwater drains	**Illegal discharge**. Stormwater drains are directly connected to rivers
Not replacing paint booth filters	Exceeding discharge standards + fire risk
Turning off dust collector power during work	**Non-operation of pollution prevention facilities** — reason for suspension of operations
Disposing used oil into general trash	Illegal disposal of designated waste

Learn to **distinguish between stormwater and wastewater drains**. Their covers and markings differ.

Environmental Impact Assessment

Businesses of certain scale (e.g., industrial park development, large-scale factory construction/expansion) must obtain an **environmental impact assessment** before starting construction. Smaller-scale businesses are subject to **small-scale environmental impact assessment**.

Integrated Environmental Permit

This system consolidates multiple permits (air, water, waste, etc.) into one. **Industries with large annual air/water pollutant discharges** (e.g., power generation, refining, chemicals, non-ferrous metals, 19 industries) are targets, and it is reviewed every 5 years.

First Week Check List

- [ ] What air and water discharge facilities are at our factory
- [ ] Location and operational status of pollution prevention facilities (dust collectors, scrubbers, wastewater treatment plants)
- [ ] Stormwater / Wastewater drain identification markings
- [ ] Who is the environmental officer (environmental technician)

Sources: Ministry of Environment — Environmental Policies and Laws and Regulations (https://www.me.go.kr) · Korea Environment Corporation — Workplace Environmental Management (https://www.keco.or.kr) · National Legislative Information Center — Air Environment Conservation Act / Water Environment Conservation Act (https://www.law.go.kr)

Waste management

Learn to distinguish between general waste and designated waste, separate disposal, and the waste transfer document (Waste Management Act).

If You Dispose Improperly, the Disposer Bears Full Responsibility

Disposing of waste does not end just because you handed it over to a disposal company. According to the **Disposer Liability Principle**, if the entrusted company illegally dumps waste, **the company that disposed of it will also be penalized**. That is why verifying the permit of the entrusted company is important.

Workplace Waste Classification

Workplace Waste ├── General Workplace Waste │ ├── Waste from Pollution Control Facilities (from air/water pollution control facilities) │ └── Other Workplace Waste (office trash, packaging materials, etc.) └── Designated Waste ← Requires special management due to its hazardous nature

Representative Designated Waste Generated in Manufacturing

Item	Where It Comes From
Used Oil	Replacement of cutting oil, hydraulic oil, and lubricating oil
Used Acids/Used Alkalis	Cleaning, etching, and plating processes (pH ≤ 2 or ≥ 12.5)
Used Organic Solvents	Thinner, cleaning solvents
Used Paint/Used Lacquer	Painting process, paint booth sludge
Used Absorbents/Used Absorbent Materials	Oil-stained rags, absorbent pads, filters
Dust	Dust collected by dust collectors
Used Fluorescent Lamps/Used Batteries	Light replacement, forklift batteries

> **Oil-stained gloves and rags are also designated waste (used absorbents)**. Throwing them in regular trash bins is a violation. Many people are unaware of this.

Storage Standards

- **Designated waste can be stored for a maximum of 45 days** (general waste: 90 days)
- **Mandatory signage** — type of waste, allowable storage volume, manager in charge, storage period
- Floor must be **non-permeable material**, roof and walls must block rain and wind
- **Used oil and used acids must be stored within curbing (oil containment berms)**
- **Separate wastes that react with each other** (used acids + used alkalis, used oil + oxidizers)

Allbaro Electronic Transfer System

When transferring waste, **electronic records are used instead of paper** for transfer and receipt.

1. Disposer inputs transfer information
2. Transporter confirms receipt
3. Disposal company confirms final disposal
4. **System tracks until disposal is completed**

Failing to use the transfer form or falsifying entries is subject to fines.

Verify These Before Outsourcing

- [ ] **Permit** of the collection/transport company (whether our waste is included in the permitted items)
- [ ] **Permit and disposal capacity** of the final disposal company
- [ ] Contract must specify waste type, quantity, and disposal method
- [ ] Vehicle registration number matches the permit

Reduction Is the Best Option

Disposal costs are continuously rising. The order is **reduction → reuse → recycling → incineration → landfill**.

- Cutting oil can be **refined and reused**, significantly reducing used oil generation
- Packaging materials should be **converted to reusable containers**
- Proper sorting prevents **recyclable items from mixing with designated waste**, which would lead to costly disposal

On-Site Mistake Examples

Mistake	Result
Mixing rags and gloves with used oil drums	Disposal rejected, reclassification costs incurred
Exceeding 45-day storage period	Fine
Missing signage	Fine
Not completing the transfer form	Fine + investigation for suspected illegal disposal

Sources: Korea Environment Corporation — Olbaryo System (Proper Disposal of Waste) (https://www.allbaro.or.kr) · Ministry of Environment — Waste Management Policy (https://www.me.go.kr) · National Laws and Regulations Information Center — Waste Management Act (https://www.law.go.kr)

Try this on site

- Waste Classification Quiz
- Determination of Waste Disposal Route Based on MSDS

Chemical Substance Safety Management

Read the MSDS and prevent hazards

What you will learn

- Understand the 16 sections of the MSDS
- GHS warning labels can be read.

GHS Classification and Warning Labels

You will learn the meaning of 9 GHS pictograms (explosion, flammable, oxidizing, corrosive, toxic, etc.).

GHS Makes It Possible to Recognize Hazards Just by Looking at the Pictures

GHS (Globally Harmonized System) is a system that unifies the classification and labeling of chemical substances worldwide. It is dangerous to handle imported chemical substances when the labels differ by country.

Korea has adopted GHS under the **Occupational Safety and Health Act** and the **Chemical Substance Control Act**.

9 Pictograms

A black image is placed inside a red diamond border.

Picture	Meaning	On-site Example
💥 Explosion	Explosive, self-reactive	Organic peroxides, hardener
🔥 Flame	**Flammable**, self-ignitable	Syrup, acetone, alcohol
🔥○ Flame over a circle	Oxidizing	Hydrogen peroxide, nitric acid
🌬 Gas cylinder	High-pressure gas	Oxygen, argon, nitrogen cylinder
🧪 Corrosion	**Metal and skin corrosion**	Sulfuric acid, sodium hydroxide
☠️ Skull	**Acute toxicity (fatal)**	Cyanide, formaldehyde
❗ Exclamation mark	Irritant, mild toxicity	General cleaning agent
🫁 Health hazard	Carcinogenicity, reproductive toxicity, respiratory allergy	Benzene, crystalline silica
🐟🌲 Environment	Harmful to aquatic environment	Heavy metal-containing chemicals

> **Skull ☠ and exclamation mark ❗ both indicate toxicity**, but their intensity differs. If a skull is present, it is lethal even in small amounts.

Signal Words — "Danger" vs "Warning"

- **Danger**: More severe level
- **Warning**: Relatively less severe level

Even if something is flammable, if the flash point is low, it is labeled "Danger," and if high, "Warning" is used.

6 Mandatory Elements on the Warning Label

1. Name (Product name)
2. **Pictogram (Graphic symbol)**
3. **Signal word** (Danger / Warning)
4. **Hazard statement** (H-code, e.g., H225 Highly flammable liquid and vapor)
5. **Precautionary statement** (P-code, e.g., P210 Keep away from heat/sparks)
6. Supplier information (Manufacturer/importer, contact details)

Labels Are Also Required on Small Containers

When transferring from a drum to a smaller container, you must also attach a warning label to that container. Many accidents occur due to not following this rule.

> Putting syrup in a PET bottle is **absolutely prohibited**. There have been repeated incidents of death due to mistaken consumption as beverages.

On-site Check List

- [ ] Is a warning label attached to the container of the chemical substances I use?
- [ ] Do I know how many pictograms there are and what each means?
- [ ] Is the signal word "Danger" or "Warning"?
- [ ] Have I attached a label to the small container?
- [ ] Is the MSDS **posted or available** in the workplace (legal obligation)

Sources: KOSHA — MSDS/GHS Data Room (https://msds.kosha.or.kr) · Chemical Safety Agency — Chemical Information (https://icis.me.go.kr) · Ministry of Employment and Labor — Guide on Warning Labels for Chemical Substances (https://www.moel.go.kr)

MSDS 핵심 항목

Learn how to read sections on chemical product identification, hazards and health hazards, emergency measures, handling/storage, and exposure prevention/personal protective equipment.

MSDS has 16 items, but you only need to see 5 on-site

MSDS(Material Safety Data Sheet, now called SDS) consists of 16 items. You don't need to memorize all of them, but you must definitely know how to read the **5 items that you must check before work**.

Structure of All 16 Items

Item	Content
1	Information about the chemical product and company
2	**Hazard and Risk** ← Required
3	**Names and Contents of Components** ← Required
4	**Emergency Response Procedures** ← Required
5	Handling methods in case of explosion or fire
6	Handling methods in case of leakage
7	**Handling and Storage Methods** ← Required
8	**Exposure Prevention and PPE** ← Required
9	Physical and chemical properties
10	Stability and reactivity
11	Toxicity information
12	Environmental impact
13	Precautions for disposal
14	Information required for transportation
15	Legal regulations
16	Other references

How to Read Each Item

2 — Hazard and Risk

Pictograms, signal words, and H-phrases are here. If you see a label like **"Carcinogenicity 1A"**, it is a specially managed material. You must keep records for **30 years**.

3 — Composition

There are cases where **the composition is hidden due to trade secrets**. Even in such cases, components with high hazards must be disclosed. You can search for individual components using **CAS numbers**.

4 — Emergency Response

It is too late to read this after an accident. Read it in advance.

- If it gets in the eyes: Wash with **running water for at least 15 minutes**
- If it contacts the skin: Immediately remove contaminated clothing and wash
- If inhaled: Move to a place with fresh air

7 — Handling and Storage

- Materials that **must not be stored together** (mixing prohibited)
- Storage temperature, ventilation requirements
- Whether grounding is required

8 — Exposure Prevention and PPE

This is the most practical item.

- **Exposure limits (TWA, STEL)** — 8-hour average / short-term
- Required **type of respiratory protection** (dust mask or gas mask, type of filter)
- Glove material (**nitrile/neoprene/butyl** — different materials are penetrated by different substances)

> If you wear **latex gloves** with organic solvents, they will permeate within a few minutes. **Always use the material specified in the MSDS**.

Reading Exposure Limits

TWA (Time-Weighted Average): Average concentration limit for 8-hour work STEL (Short-Term Exposure Limit): Maximum concentration allowable for 15 minutes C (Ceiling): Value that must not be exceeded even momentarily

Example) Toluene TWA 50ppm / STEL 150ppm

Legal Obligations (Employer)

- **Post and display MSDS in a place where workers handling the substance can easily see it**
- Attach warning labels
- **Conduct MSDS training** (every time the substance changes or is newly introduced)
- Since 2021, **MSDS submission and non-disclosure approval system** is in operation (KOSHA)

What New Employees Must Do on Their First Day

- [ ] Confirm the list of chemical substances used in your process
- [ ] Confirm the location of MSDS for each substance (file cabinet or bulletin board)
- [ ] Read items 4 (Emergency Response) and 8 (PPE) in advance
- [ ] Confirm the location of eye wash and emergency shower — **must be reachable within 30 seconds**

Sources: Korea Occupational Safety and Health Agency (KOSHA) — MSDS Search System (https://msds.kosha.or.kr) · Ministry of Employment and Labor — Chemical Substance Management Guidelines (https://www.moel.go.kr) · Chemical Safety Agency — Comprehensive Information System for Chemical Substances (https://icis.me.go.kr)

Try this on site

- MSDS 3종 읽기 실습
- GHS Pictogram Matching Quiz

Workers' Rights and Labor Law

You need to know your rights to protect them.

What you will learn

- Understand basic working conditions
- Know how to respond to unfair treatment

The employment contract

Learn about the mandatory items to include in employment contracts, working hours, rest periods and holidays, and the legal standards for annual paid leave.

If You Don't Use a Contract, the Loss Always Falls on the Worker

Because of urgency, because it's someone you know who introduced you, or because of the phrase "we'll write it later," many people still start work without a labor contract. However, if later disputes arise over wages or working hours, **spoken promises have no way of being proven**. Inspectors also have no basis for judgment.

Creating and **delivering** a labor contract is the employer's legal obligation (Labor Standards Act Article 17). Just writing it and having the company keep all copies is also a violation. **One copy must be given to the worker to keep**.

> Not receiving a contract itself is a reportable issue. Take a photo of it, even. When disputing unpaid wages later, the first document requested will be the labor contract.

Items That Must Be in Writing

Item	What Should Be Written for It to Be Normal
Wages	Components (base pay, allowance amounts), calculation method, payment method and payment date
Prescribed Working Hours	Start and end times, how many hours per day/week
Days Off	Which day of the week is the weekly day off, whether public holidays are paid
Annual Paid Leave	Criteria for granting
Workplace	Actual factory or workplace where work is performed
Job Responsibilities	The more specific, the better than vague terms like "manufacturing assistance"

A contract that only says **"Wages = OOO million won per month"** is a **deficient contract**. If base pay and overtime allowances are not clearly separated, it will be impossible to determine later whether overtime pay has already been received or not.

Legal Standards for Working Hours, Breaks, and Days Off

Category	Standard
Prescribed Working Hours	**8 hours per day**, **40 hours per week** or less
Overtime Work	Up to **12 hours per week** by mutual agreement
Breaks	30 minutes or more for 4 hours of work, **1 hour or more** for 8 hours of work — **during working hours**
Weekly Day Off	If you work the prescribed working days for a week, you are entitled to **at least 1 day of paid leave**
Night Work	**10 PM to 6 AM**

Break time is free time to rest. Watching machines while eating is not break time but working time. If you cannot leave your post even while waiting, that counts as working time.

Annual Paid Leave is Accumulated Like This

[Less than 1 year of employment] 1 day for every month worked → Maximum 11 days

[1 year of employment, with at least 80% attendance in the previous year] 15 days

[Continued employment for 3 years or more] 1 additional day for every 2 years beyond the first year 3-4 years: 16 days 5-6 years: 17 days 7-8 years: 18 days ... 21 years or more: 25 days (limit)

Annual leave is **principally used on the day the worker chooses**. The company can only request a change in timing if it causes significant disruption to business operations. Unused annual leave is **principally settled as annual leave pay** (exception if the company follows legal procedures to encourage usage).

If the Workplace Has Fewer Than 5 Employees, the Standards Are Different

In the Busan, Ulsan, and Gyeongnam regions, there are not a few companies in the second and third-tier subcontractors with fewer than 5 regular employees. **Depending on how many people are in your company, different provisions apply.**

System	Fewer than 5 Employees	5 or More Employees
Minimum Wage	Applied	Applied
Labor Contract Creation and Delivery	Applied	Applied
Weekly Day Off Pay	Applied	Applied
Severance Pay	Applied	Applied
Workers' Compensation Insurance	Applied	Applied
Overtime, Night Shift, and Holiday Premium Pay (50%)	**Not Applied**	Applied
Annual Paid Leave	**Not Applied**	Applied
Weekly 52-Hour Limit	**Not Applied**	Applied
Redress for Unfair Dismissal	**Not Applied**	Applied

The number of regular employees is determined by **actual number of employees**, not the employer's personal statement. If you're confused, ask the Korea Labor Welfare Service Customer Consultation Center (**1350** without area code).

Confirm Who Your "Employer" Is

In shipyards and auto parts manufacturing sites, it's common for multiple internal subcontractors to be inside the main contractor. The company written on the labor contract (your employer) and the person giving instructions on-site may belong to different companies.

- **Subcontracting**: Subcontractor manager gives orders. Normal structure.
- **Dispatching**: Allowed tasks and periods are set under the Dispatch Act, and direct manufacturing processes in manufacturing are **principally prohibited**.

If the main contractor's employee directly gives work instructions and manages attendance, it may be illegal dispatching. Since this is a difficult issue to judge, if you feel something is wrong, consult the Labor Inspection Office first.

Additional Checks for Foreign Workers (E-9)

- Use the **Standard Labor Contract**. Keep a translated version in your native language.
- **It is illegal for the company to keep your passport and foreign registration certificate**. Keep them yourself.
- Discriminating wages or working conditions based on nationality violates the Labor Standards Act Article 6. Minimum wage is also **applied equally** to domestic workers.
- Changing workplaces is allowed within a set number of times, but **reasons not related to the worker's responsibility**, such as the employer's violation of working conditions, are **not counted** toward that limit. Check with the Employment Center.
- Consultation for foreign workers: **1577-0071** (Multilingual consultation support)

Checklist Before Signing

- [ ] Is the wage clearly **separated into base pay and allowances**?
- [ ] Are the start and end times and break time **specifically written**?
- [ ] Is the weekly day off **written as which day of the week**?
- [ ] Did you not sign with **blank spaces**? (**Absolutely prohibit signing with blank spaces**)
- [ ] **Did you receive one copy of the signed contract**?
- [ ] Did you take a photo and save it on your **mobile phone**?

Sources: Ministry of Employment and Labor — Standard Employment Contract Form and Guidelines for Completion (https://www.moel.go.kr) · National Legislative Information Center — Labor Standards Act (https://www.law.go.kr) · Ministry of Employment and Labor Complaint and Inquiry Forum — Consultation on Working Conditions and Complaint/Petition Submission (https://minwon.moel.go.kr)

Wages and the four major insurances

Learn the basics of minimum wage, regular wages, severance pay, and National Pension, Health Insurance, Employment Insurance, and Industrial Accident Compensation Insurance.

Knowing How to Read Pay Slips Prevents Losses

Just looking at "how much money came into your account" won't tell you what you're missing out on. Wages are structured as **basic pay + various allowances – deductions (four major insurances, taxes)**, and each item has its own calculation basis.

Since **November 2021**, employers have a **mandatory obligation to provide a wage statement** (Article 48 of the Labor Standards Act). Every time wages are paid, a written or electronic document must be provided that includes the wage components, calculation methods, and deduction details. Failing to do so can result in fines.

Minimum Wage — Revised Annually

The minimum wage is **determined and announced in early August for the following year**, and it becomes effective **from January 1st of the following year**. Since the amount changes every year, **you must confirm the announced amount for that year**. It is posted on the Ministry of Employment and Labor website and on the workplace notice board.

These are the principles to remember:

- **Applies to all workplaces with one or more employees**. There are no exceptions, even for workplaces with fewer than five employees.
- **Irrespective of nationality**. The same amount applies to E-9 foreign workers as well.
- For workers with a contract of one year or more, **a 10% reduction is allowed during the first three months of training**, but **simple labor occupations specified by the Ministry of Employment and Labor cannot be reduced**.
- The scope of wages included in the minimum wage (whether regular bonuses and welfare benefits are included) has changed gradually due to legal revisions. When calculating whether your wage violates the minimum wage, **check the standard for that year**.

> Whether the minimum wage is violated is determined by **hourly pay**, not the **total monthly salary**. You must divide the monthly salary by the scheduled working hours for that month and compare it.

Regular Wage and Average Wage — Used in Different Places

Category	Definition	Where It Is Used
Regular Wage	The amount regularly and uniformly paid as compensation for scheduled work	Overtime, night shift, holiday, annual leave, and termination notice allowances
Average Wage	The total wage over the previous **three months divided by the total number of days in that period**	Severance pay, compensation for work-related injury and sick leave, and sick pay

If the average wage is lower than the regular wage, **the regular wage is considered the average wage**.

The determination of which allowances are included in the regular wage has been continuously clarified by court rulings, and there have been changes in practical standards, such as the treatment of regular bonuses with employment conditions. **Many companies narrow the scope of regular wages and give fewer allowances**, so if the amount seems unreasonable, **consult the Labor Inspection Office**.

Regular Hourly Rate and Additional Allowance Calculations

In the 40-hour workweek system, the monthly scheduled working hours are usually calculated as **209 hours**.

```
Monthly scheduled working hours = (40 hours per week + 8 hours of weekly holiday) × 365 days ÷ 7 days ÷ 12 months
                                = 48 × 52.14 ÷ 12
                                ≈ 209 hours

Example) If the monthly salary that qualifies as regular wage is 2,090,000 won,
        Regular hourly rate = 2,090,000 ÷ 209 = 10,000 won

        Overtime 10 hours → 10,000 × 1.5 × 10 = 150,000 won
        Night work 8 hours → 10,000 × 0.5 × 8 = 40,000 won (only the additional part)
        Holiday work 8 hours → 10,000 × 1.5 × 8 = 120,000 won
        Excess hours on holiday 8 hours → 10,000 × 2.0 × excess hours
```

If overtime work is also night work (work after 10 PM), the additional allowances overlap. The 50% overtime rate plus the 50% night work rate makes it double the regular hourly rate. This part is often overlooked in shipbuilding and casting workplaces where night work is common.

Severance Pay

- **If you have worked continuously for one year or more**, and your **average scheduled working hours per week is 15 hours or more over four weeks**, you are eligible.
- **Applies to all workplaces with one or more employees**. Even workplaces with fewer than five employees are eligible.
- The principle is that it should be paid **within 14 days from the day of resignation**, although it can be extended by agreement.

```
Severance pay = Average daily wage × 30 days × (Number of continuous working days ÷ 365)

Example) Total wages for the previous three months: 9,200,000 won, total number of days in that period: 92 days
        Average daily wage = 9,200,000 ÷ 92 = 100,000 won

        If you have worked continuously for 1,278 days (about 3 years and 6 months),
        Severance pay = 100,000 × 30 × (1,278 ÷ 365)
                      = 3,000,000 × 3.5014
                      ≈ 10,504,000 won
```

> **A contract stating that "severance pay is included in the monthly salary" (severance pay split agreement) is generally invalid**. You can claim it separately when you resign.

For E-9 foreign workers, severance pay is replaced by **Departure Insurance** that the employer joins. If the insurance payout is less than the legally mandated severance pay, **the employer must cover the difference**. Be sure to compare the amounts.

Four Major Insurances — Different Parties Bear the Burden

Insurance	What It Covers	Insurance Premium Burden
National Pension	Old-age, disability, and survivor pensions	Shared equally by the employee and the employer
Health Insurance	Medical and injury treatment costs, long-term care	Shared equally by the employee and the employer
Employment Insurance	Unemployment benefits, vocational training, and childcare leave pay	Shared equally for unemployment benefits, **fully borne by the employer for employment stability and vocational training programs**
Work Injury Insurance	Treatment and compensation for work-related injuries	**Fully borne by the employer**

Insurance premium rates **change annually by announcement**, so check the rate for that year. Just remember the structure accurately.

Work injury insurance premiums are not paid by the employee at all. If the work injury insurance premium is deducted on the pay slip, it's incorrect. Also, **work injury insurance is automatically applied if there is at least one employee**, so even if the

company doesn't join, the employee can still receive compensation if injured.

Four Major Insurances for Foreign Workers

- **Health Insurance and Work Injury Insurance**: Apply.
- **National Pension**: Depending on mutual recognition between countries, the application and eligibility for lump-sum payments vary by nationality. Be sure to confirm based on your nationality.
- **Employment Insurance**: Depending on the stay status, it may be automatically applied or optional.
- In addition, foreign workers have **Departure Insurance, Return Cost Insurance, Accident Insurance, and Wage Arrears Guarantee Insurance** separately. Be sure to check who is joining and when you can receive benefits at the time of the contract.

What to Check on the Pay Slip

- [ ] Is **basic pay** and each allowance clearly separated by item?
- [ ] Do **overtime, night shift, and holiday working hours** match the actual hours worked?
- [ ] Is **work injury insurance premium** not deducted? (If it is, it's an error)
- [ ] Is **registration for the four major insurances** actually completed? (You can check yourself on the Korea Health Insurance Corporation and National Pension Service websites)
- [ ] Are **monthly pay slips stored as files**? — This is key evidence in disputes over unpaid wages.

Sources: Ministry of Employment and Labor — Minimum Wage and Wage System Guidance (https://www.moel.go.kr) · National Legislative Information Center — Minimum Wage Act / Laborer's Pension Guarantee Act (https://www.law.go.kr) · Korea Labor Welfare Corporation — Employment and Industrial Accident Insurance Enrollment and Premiums (https://www.comwel.or.kr)

Responding to unfair treatment

We provide contact information and procedures for reporting wage arrears, unfair dismissal, workplace harassment, and industrial accidents.

While You're Holding Back, Time Is Passing

When you experience unfair treatment, the most common reaction is "Let's just hold back for now." However, labor rights have **deadlines**. Wages claims have a **3-year** statute of limitations, and applications for redress against unfair dismissal have a **3-month** deadline. If you miss these periods, even if your case is justified, you won't be able to pursue it.

Also, reporting is not something that will harm the company. In most cases, it ends with **correction orders and payment**.

Most importantly — Gather Evidence

The only thing investigators can rely on is **records**. Keep the following documents on hand at all times.

Evidence	Why It's Needed
Copy of the employment contract	Basis for agreed wages and working hours
Pay slips, bank deposit records	Actual amount paid
In-and-out records (fingerprint or card records, work logs, handwritten notes by the employee)	Key to proving overtime work
Captured work instructions via text or messenger	Content and timing of instructions
Audio recordings	**Recordings are allowed if you are a participant in the conversation**

> Even handwritten work records can be accepted as evidence if they are **written on the same day** as the event. Records written later are less credible.

Wages in Arrears

Wages must be paid in full, on time, in cash, and directly to the employee (the **Four Principles of Wage Payment**). In the case of resignation, all wages and severance pay must be settled within **14 days** from the date of resignation.

Reporting Procedure

```
① Submit a complaint to the local Employment and Labor Office (branch office)
   - Online: Apply for "Wage Arrears Complaint" on the Ministry of Employment and Labor's Citizen Service Platform
   - In-person or by mail is also possible
   ↓
② Assign a labor inspector → Conduct an on-site investigation (face-to-face with the employee and employer)
   ↓
③ If arrears are confirmed → Issue a correction order → Employer pays
   ↓
④ If the employer still does not pay → Issue a Wage Arrears Verification Form
   → Request for lump-sum payment / Civil lawsuit / Criminal prosecution of the employer
```

- **Jurisdiction**: Based on the location of the workplace. In Busan, Ulsan, and Gyeongnam, the **Busan Employment and Labor Office** and its subordinate branches (Busan East, Busan North, Changwon, Ulsan, Yangsan, Jinju, Tongyeong) are responsible.
- **Lump-sum payment**: When the company is bankrupt or lacks the ability to pay, the **Korea Labor Welfare Corporation** provides payment up to a certain limit. There are set limits and deadlines, so check with the corporation (**1588-0075**).
- **Late interest**: If wages are not paid within 14 days after resignation, a **20% annual interest** is applied from the next day (not applicable for unpaid wages during employment).

Unfair Dismissal

Check Item	Criteria
Written notice of dismissal	Must be given in **writing** to be valid (for companies with 5 or more employees). Verbal or text-based dismissal may be invalid
Notice period	30 days' notice or **at least 30 days' worth of regular wages** (dismissal notice pay). Exceptions apply for those with less than 3 months of continuous employment
Just cause	Companies with 5 or more employees cannot dismiss employees without **just cause**
Deadline for redress application	Must be applied to the local Labor Commission within **3 months** from the date of dismissal

In Busan, Ulsan, and Gyeongnam, the **Busan Labor Commission, Ulsan Labor Commission, and Gyeongnam Labor Commission** are responsible based on the workplace location (these are separate agencies, so confirm the jurisdiction before submitting your application). **There is no cost** for filing a redress application, and if you meet certain conditions, you may also receive support from a state-appointed labor lawyer.

> Be cautious if asked to **sign a resignation letter**. Signing it may be considered **voluntary resignation**, making it harder to challenge unfair dismissal and affecting unemployment benefits. If you are not satisfied, **do not sign** and seek consultation first.

Workplace Harassment

Workplace harassment as defined by law occurs when all three of the following conditions are met:

1. Using **superior position or relationship** in the workplace
2. **Exceeding the appropriate limits of work-related behavior**
3. Causing **physical or mental suffering** or **deteriorating the working environment**

Legitimate work instructions or reprimands are not included. On the other hand, verbal abuse, bullying, not assigning work, personal errands, or mockery based on nationality may fall under this category.

Handling Procedure

```
① Anyone can report to the employer (not necessarily the victim)
   ↓
② The employer must investigate immediately
   ↓
③ During the investigation, the victim must be protected (e.g., changing the workplace, paid leave, etc.)
   → Measures against the victim's wishes are not allowed
   ↓
④ If confirmed, the perpetrator must be disciplined or reassigned
   ↓
⑤ If the company does not investigate or take action → Submit a complaint to the local labor office
```

> **Harassment or adverse treatment of the complainant or victim is a criminal offense**. This is the key reason why reporting is possible. Applies to workplaces with 5 or more employees.

Workplace Injury — Don't Just Accept Recommendations for Non-Industrial Accident Handling

It is common to be offered something like, "If you report this as a work injury, the company will be in trouble, so we will pay for your medical expenses." This is called **non-industrial accident handling**. The problem is as follows:

- The money the company provides is usually **only for medical expenses**. **Wage compensation for days not worked** and **disability compensation for after-effects** are not included.
- If after-effects develop later, it will be **difficult to get recognition again** without records.
- **Hiding a work injury is a crime by the employer**. It is not the employee's responsibility to be considerate.

Work injuries can be **applied for directly by the employee to the Korea Labor Welfare Corporation**, **without the company's approval**. Even if the company refuses to stamp the application, it is still possible to apply.

Where to Report — Summary Table

Issue	Reporting Office	Deadline
Wages in arrears, minimum wage violations, unpaid overtime pay, failure to provide employment contracts	Submit a complaint to the local **Employment and Labor Office** (online citizen service platform)	**3 years** for wage claims
Unfair dismissal or punishment	**Local Labor Commission** for redress application	**3 months** from the date of dismissal
Workplace harassment	Report to the company → If not addressed, submit a complaint to the labor office	—
Workplace injury	Apply for medical benefits at the **Korea Labor Welfare Corporation** branch	3 or 5 years depending on the type of benefit
Dangerous work instructions, lack of safety measures	Labor Office's occupational safety department / Korea Occupational Safety and Health Agency	—
General labor law consultation	**1350** Employment and Labor Ministry Customer Service Center	—
Consultation for foreign workers (multilingual)	**1577-0071**	—

What Foreign Workers Should Especially Know

- You **cannot be treated unfairly or forced to leave the country** just because you made a report.
- Violations of working conditions by the employer, wage arrears, or unfair treatment are **valid reasons for changing the workplace**, and in this case, the number of changes is not counted. Report the reason accurately to the employment center.
- Do **not comply** with requests to hand over your **passport or foreign registration certificate**, or to submit your **bankbook or credit card**.
- Consultations can be received in your **mother tongue** at **1350** (with interpretation support) and **1577-0071**.

Check Today

- [ ] Do I have a **copy of the employment contract**?
- [ ] Am I keeping **pay slips and bank deposit records** for the last **3 months**?
- [ ] Am I **recording my in-and-out times and overtime hours every day**?
- [ ] Do I know **which local Employment and Labor Office** is responsible for my company?
- [ ] Do I know that I can **apply for a work injury claim myself** if I get hurt?

Sources: Ministry of Employment and Labor Citizen Complaint Platform — Filing a Petition for Wage Arrears, etc. (https://minwon.moel.go.kr) · Ministry of Employment and Labor — Guidance on Determining, Preventing, and Responding to Workplace Harassment (https://www.moel.go.kr) · National Legal Information Center — Labor Standards Act (Dismissal and Harassment Provisions) (https://www.law.go.kr)

Try this on site

- Check Key Items in Employment Contract
- Ministry of Employment and Labor Reporting Procedure Confirmation

Understanding the shop floor

How a factory runs, and how to read drawings and materials.

Manufacturing Site Orientation

First Steps for Manufacturing Beginners

What you will learn

- Understand the basic structure and flow of the manufacturing site
- Learn the work rules and basic manners
- Familiarize yourself with on-site terminology.

What is a Manufacturing Site?

Flow of raw materials to finished products: incoming → processing → assembly → inspection → shipping. Understand the differences in factory layout (production line, cell, batch production).

The factory is a "river of goods"

When you first enter the manufacturing site, you may be overwhelmed by the sound of machines, forklifts, and stacked boxes. However, the factory actually operates on a very simple principle: **raw materials come in from one side, go through various processes, and become finished products that exit from the other side.** If you can visualize this flow in your mind, you will immediately understand where your position is within the whole system.

1. The 5-Step Flow of Manufacturing

```
[Incoming]  →  [Processing]  →  [Assembly]  →  [Inspection]  →  [Outgoing]
 Materials      Shape Making   Combining    Checking     To Customers
```

Step	Task	Example at Bupyeong Site
Incoming (Import)	Receive raw materials and parts from suppliers and confirm quantity and quality	Steel plates, bolts, parts before painting
Processing	Create shapes through cutting, pressing, welding, and heat treatment	CNC lathes, machining centers, robotic welding
Assembly	Combine processed parts and purchased parts to complete the product	Engine part assembly, block installation on ships
Inspection	Confirm that dimensions, appearance, and performance meet specifications	3D measuring machine, visual inspection, leak test
Outgoing	Package and load for delivery to customers	Hyundai Motor's sequential delivery, block transfer to shipyards

A common mistake for new employees: It's not just about doing your own process well. If the previous process is slow, you will be idle, and if you are slow, the entire subsequent process will stop. This is called **"the line stops"**, and it is the most situation to avoid in the manufacturing site.

2. Three Types of Factory Layouts

Even if the same product is being made, the factory layout varies from company to company. Knowing the layout where you will be placed can greatly speed up your adaptation on the first day.

Line Production (Conveyor Belt Method)

- Products move along the conveyor belt, and workers **repeat the same task at one location**
- Advantages: Favorable for mass production, short training time
- Disadvantages: If one person is late, the entire line stops, monotonous
- Examples: Finished cars and parts, home appliance assembly

Cell Production (U-shaped, One-Person Completion)

- One person or a small group **handles multiple processes up to the finished product**
- Advantages: Favorable for small-batch, multi-variety production, improves worker skill and sense of responsibility
- Disadvantages: Takes longer time to become proficient
- Examples: Industrial machinery, automotive parts, multi-variety parts

Batch Production

- Same items are **produced in batches and then switched to the next item (changeover)**
- Advantages: One machine can handle multiple products
- Disadvantages: Preparation time (**tool change, setup**) occurs when switching products
- Examples: Electroplating, heat treatment, chemical and food products

3. Flow Terms Used on the Site

Term	Meaning	How It Is Used
Previous Process / Next Process	My previous step / my next step	"The previous process isn't sending the quantity"
Work in Progress (WIP)	Partially completed inventory	"WIP has accumulated = the downstream is blocked"
Takt Time	Target production time per unit	"Takt 45 seconds" = 1 unit every 45 seconds
Cycle Time	Actual time taken for the work	If longer than takt time, the line is delayed
Bottleneck (Bottleneck)	The slowest process that delays the whole	"The third process is a bottleneck"
Lead Time	Total time from order to delivery	The standard for customer delivery promises

4. Three Things to Understand in the First Week

- [ ] Whether our factory uses **line, cell, or batch** production
- [ ] Who/where **the previous and next processes** are (including names)
- [ ] Where our product is going to **which customer** (final use)

Understanding these three things will start helping you understand **"why this work has to be done this way."** The difference between someone who just follows orders and someone who understands the flow becomes clearly visible after six months.

Sources: Smart Manufacturing Innovation Promotion Office — Smart Factory Overview (https://www.smart-factory.kr) · Korea Productivity Center — Basic Production Management (https://www.kpc.or.kr) · Korea Industrial Complex Corporation (KICOX) (https://www.kicox.or.kr)

Work System

Learn about the differences between weekday, night, and shift work (two-shift, three-shift), managing arrival and departure times, the concept of overtime (OT), and rest break regulations.

Manufacturing: "Time" is both Pay and Trust

Unlike office work, the manufacturing site starts the **production line at a fixed time**. If I am one minute late, the production line will be one minute late, or someone else has to stand in for me. Therefore, in manufacturing, time commitments are evaluated before ability.

1. Three Shift Systems

System	Work Type	Features
Fixed Weekly	08:00~17:00 fixed	Stable lifestyle rhythm, no night shift allowance
Two Shifts	Day 08~20 / Night 20~08 (12h) or Day/Night 8h + OT	↑ Equipment operation rate, night shift allowance applies
Three Shifts	Morning 06~14 / Afternoon 14~22 / Night 22~06	24-hour continuous operation, weekly rotation

Shift Rotation (Rotation): In the three-shift system, teams are usually changed every 1 week or 2 weeks. It's like "night shift this week, morning shift next week." The rotation schedule is usually distributed by the team leader on a monthly basis, so **receive it in advance and adjust your personal schedule accordingly.**

2. Statutory Working Hours

- **Statutory Working Hours:** 8 hours per day, 40 hours per week (Labor Standards Act Article 50)
- **Overtime Limit:** Up to 12 hours per week (requires mutual agreement) → **Maximum 52 hours per week**
- **Rest Time:** 30 minutes or more for 4 hours of work, **1 hour or more** for 8 hours of work (Article 54)
- **Night Work:** Work between 22:00 and 06:00

3. Allowance Calculation — Why Your Pay is This Amount

Additional rates are applied based on regular wages (Labor Standards Act Article 56).

Category	Additional Rate	Example (Based on 12,000 won hourly wage)
Basic	100%	12,000 won
Overtime (OT)	+50%	18,000 won
Night Work (22~06)	+50%	18,000 won
Overtime + Night Work Overlap	+100%	24,000 won
Holiday Work (within 8h)	+50%	18,000 won
Holiday Work (over 8h)	+100%	24,000 won

> If you work overtime during the night, **50% for overtime and 50% for night work are added separately**. Develop the habit of checking whether these items are correctly calculated in your pay statement.

4. Commuting Practices — The Unspoken Rules of the Site

- **On time = start of work time**. If the start time is 08:00, it means **arriving at 08:00 wearing the work uniform and standing at your post**, not just arriving at 08:00. It is customary to arrive 10~15 minutes early.
- **Morning Meeting (Check-in):** 5~10 minutes before the start time, confirm the day's production plan, safety notices, and personnel. Missing this means you miss all the information for the day.
- **Late arrival or absence notice:** If you are going to be late or unable to come, **contact your immediate team leader as soon as possible directly**. Don't just send a KakaoTalk message and end it — the team needs to be replaced immediately to keep the production line running.
- **Early departure or annual leave:** Applying at least one day in advance is standard. Requests on the same day may be rejected because it is difficult to adjust the production line.

5. Annual Leave (Labor Standards Act Article 60)

- **Employees with less than one year of service:** 1 day for every month of service, up to **11 days**
- **Employees with one year or more: 15 days** (an additional 1 day every 2 years, up to 25 days)
- Unused annual leave is settled as allowance (the company may operate a promotion system according to its regulations)

6. First Month Checklist

- [ ] Receive your shift rotation schedule and mark it on your calendar
- [ ] Confirm the start and end times of work and rest periods accurately
- [ ] Confirm the time and place for the morning meeting
- [ ] Save the **team leader's contact information** for late arrival or absence
- [ ] Check the basic wage, overtime, and night shift allowance items on your first pay statement
- [ ] Confirm the method for applying for annual leave (electronic approval or written application)

Sources: Labor Standards Act (National Legal Information Center) (https://law.go.kr/법령/근로기준법) · Ministry of Employment and Labor — Guidelines on Working Hours, Breaks, and Holidays (https://www.moel.go.kr) · Employment and Labor Ministry Wage Work Hours Policy Guide (https://www.moel.go.kr/policy/policydata/list.do)

Basic On-Site Etiquette

Learn the rules for wearing safety shoes, safety helmets, and protective gear, managing work uniforms, using cell phones, smoking areas, and restaurant etiquette.

Manners Are "Safety," Not "Etiquette"

On-site rules are not made because someone is picky. **Most rules are created after an accident has occurred.** Knowing why you must wear safety shoes and why you shouldn't run makes it easier to follow the rules.

1. Attire — First Thing When You Arrive

Item	Rule	Reason
Workwear	Tuck in sleeves and pants, wear shirt inside pants	Prevents clothing from getting caught in rotating parts
Safety Shoes	Always wear in designated areas, tie laces tightly	Protection from falling objects, nails, and slipping
Safety Helmet	Chin strap must be fastened	If not fastened, helmet can come off during impact and be useless
Safety Goggles	Mandatory in cutting, grinding, and welding areas	Chips and sparks can cause eye injuries (which are irreversible)
Gloves	Use designated gloves for each task	**Gloves prohibited during rotating machine operations** (can get caught)
Earplugs	Required in areas with 85dB or higher noise	Noise-induced hearing loss is irreversible

Accessories Prohibited: Rings, necklaces, watches, long hair (must be tied back). These are the number one causes of accidents during rotating machinery and electrical work.

2. Actions Not Allowed on Site

- **No running** — Running overlaps with forklift or crane paths and causes immediate accidents
- **Only use designated walkways** — Stay inside yellow and green line areas on the floor
- **Do not pass under crane loads**
- **Do not approach within 3m of a forklift** (driver's blind spot)
- **Do not operate equipment or disable safety devices arbitrarily**
- **No chatting or joking during work**

3. Use of Smartphones

It varies by company, but the common principle in manufacturing sites is as follows.

- **Prohibited during work** (hands not free = accident)
- **Check prohibited photography areas** — Blueprints, equipment, and products are mostly trade secrets. Accidentally taking photos and posting them on SNS can lead to **disciplinary action and legal liability**.
- Many places allow use only during break time or in break rooms.

4. Smoking, Cafeteria, and Break Rooms

- **Smoking**: Only in designated smoking areas. Smoking near areas with flammable materials (paint, thinner, gas) inside the factory directly leads to fire.
- **Cafeteria**: Usage times are divided by shift. It's polite to eat quickly during the designated time and move aside.
- **Break Room**: Clean up your seat for the next person. Do not leave personal items behind.

5. Greetings and Titles — 90% of First Impressions

- **Greetings**: When you meet someone, make eye contact and say "Hello." The site is noisy, so speak loudly.
- **Titles**: Use position + "sir/madam" (Team Leader, Section Leader, Department Head). Do not call by name only.
- **Ask if you don't know**: In manufacturing sites, the most dangerous person is **someone who pretends to know but doesn't**. Saying, "Excuse me, could you please show me once more how to do this?" is a much more professional attitude.

6. Keeping Things Neat (Start of 5S)

After finishing work, **put tools back in place, clean the floor, and sort waste**. This is not just a chore, but directly relates to the safety of the next person. Even a single drop of oil on the floor can cause a slip accident.

7. First Week Manners Checklist

- [ ] Receive all protective gear in your size (safety shoes, safety helmet, safety goggles, earplugs)
- [ ] Confirm the locations of designated walkways, emergency exits, and fire extinguishers
- [ ] Check the smoking areas and cafeteria usage times
- [ ] Confirm prohibited photography areas
- [ ] Memorize the names and positions of your team members
- [ ] Develop the habit of returning tools and tidying up the workbench before leaving work

Sources: Korea Occupational Safety and Health Authority (KOSHA) — Protective Equipment Safety Certification (https://www.kosha.or.kr) · Rules for Industrial Safety and Health Standards (https://law.go.kr/법령/산업안전보건기준에관한규칙) · KOSHA Safety and Health Training Materials Repository (https://www.kosha.or.kr/kosha/data/mediaBank.do)

Reporting/Contact/Consultation (Ho·Ren·So)

A reporting (報告), communication (連絡), and consultation (相談) culture originating from Japanese manufacturing. Learn the timing and method of reporting to your supervisor.

Accidents Often Get Worse Because People Don't Speak Up

Horenso (報連相) is a Japanese manufacturing term derived from the first characters of **reporting (報告), communication (連絡), and consultation (相談)**. This term has also been adopted in Korean manufacturing sites. The number one reason new employees get scolded is "why didn't you speak up?" If you understand these three distinctions, most issues can be resolved.

1. Three Distinctions

Distinction	Direction	When	Example
Reporting (報告)	Down → Up	**Result or Progress** of a task assigned	"The 300 items you asked me to inspect are done. There were 2 defective items."
Communication (連絡)	All directions	Sharing **Factual Information** with relevant parties	"Equipment 3 will be inspected starting at 2 PM."
Consultation (相談)	Down → Up	**When it's difficult to make a decision**, seeking opinions	"This dimension is a bit ambiguous. Is it okay to approve it?"

2. Three Principles of Reporting

① The worse the news, the faster you should report

Defects, equipment problems, injuries, and delayed delivery — **bad news becomes more costly the longer it is delayed**. If you report 10 defects, you only lose 10, but if you hide them and 1,000 defects occur, you will face customer complaints, full inspection, and loss of trust.

> On-site saying: **"Good news can come slowly, but bad news must come quickly."**

② Start with the conclusion, and separate facts from opinions

```
[Bad example]
"Oh, that is, earlier when I was working on Line 3, I heard some strange noise,
and it looked like something was wrong..."

[Good example]
"Abnormal noise from Equipment 3, work stopped.       ← Conclusion
Noise occurred at 2:10 PM during cutting.          ← Fact
Looks like a bearing issue, please check.        ← Opinion (separated)"
```

③ Report without missing any 5W1H

When, where, what, why, how, and how much. Especially in manufacturing, **quantity and timing** are key. Instead of saying "some defects occurred," say "Between 2 PM and 3 PM, 12 defects were found in 200 produced items."

3. Situations That Require Immediate Reporting (No hesitation)

- When someone is injured (even if it's minor)
- **Near Miss** (a situation where injury almost occurred)
- Equipment abnormal noise, vibration, overheating, or leakage
- Defects occurred or suspected deviation from specifications
- Material shortage or quality issues
- When the actual situation differs from the work instructions
- When you think you won't be able to meet the deadline or quantity

4. Consultation — "If You Don't Know, Stop and Ask"

The rule in manufacturing is **"When in doubt, stop."**

- Making a judgment on your own when something is unclear → Risk of mass defects
- Taking 5 minutes to ask is better than losing a day's production due to a wrong decision

Good way to consult: Instead of just asking "What should I do?" **include your thoughts** when you ask. > "This dimension is near the upper limit. In my opinion, we should re-measure before deciding. What do you think?"

This shows that you are developing your judgment.

5. Reporting Timing

Situation	Timing
Emergency (accident, equipment stoppage, safety)	**Immediately**, in person or by phone
Work completion	Immediately after finishing
Long-term work	Mid-progress report (before the supervisor asks)
Daily work	Use inquiry and closing meeting times

> **"Report before the person who gave the instruction asks."** This one sentence is the difference between a new employee and a 3-year veteran.

6. Practice — Do It Today

- [ ] Report **first** on one task you were assigned today after completing it
- [ ] For one unclear situation, don't make a decision on your own — consult
- [ ] When reporting, speak in the order of **Conclusion → Fact → Opinion**
- [ ] If there was a **Near Miss**, share it with the team leader (you won't be scolded, you'll actually be praised)

Sources: KOSHA — Near Miss (아차사고) Discovery and Utilization Guide (https://www.kosha.or.kr) · Korea Productivity Center — On-site Communication (https://www.kpc.or.kr) · Ministry of Employment and Labor — Guide for Establishing a Safety and Health Management System (https://www.moel.go.kr)

Try this on site

- Draw a factory layout map
- 3-Day Commute Routine Checklist

5S Activities and Workplace Organization

Tidy Up, Keep Neat, Clean, and Maintain Hygiene as a Habit

What you will learn

- Understand and practice each stage of 5S (5S)
- Recognize the economic benefits of workplace organization

What is 5S?

Learn the meaning and purpose of Seiri (Sorting), Seiton (Setting in order), Seiso (Shining), Seiketsu (Standardizing), and Shitsuke (Sustaining).

This Is Not a Cleaning Campaign

If you think of 5S as "a big cleaning," you will definitely fail. 5S is a **management technique that makes waste visible**. When items are in their proper place, you can see when something is missing, and when the floor is clean, you can spot oil leaks.

5 Steps

Step	Japanese	Meaning	Key Question
1S Organization	Seiri (整理)	**Discard** what is not needed	"Is this really needed?"
2S Neatness	Seiton (整頓)	**Put** what is needed in its place	"Can I find it within 30 seconds?"
3S Cleaning	Seiso (清掃)	**Inspect** while cleaning	"Why did it get dirty?"
4S Cleanliness	Seiketsu (清潔)	**Maintain** the 1~3S condition	"Is there a standard?"
5S Discipline	Shitsuke (躾)	**Make it a habit**	"Will you do it without being told?"

Order is important. If you try to organize (neatness) without first discarding unnecessary items, you end up neatly arranging useless things.

Real Effects of 5S

Effect	Explanation
Reduced search time	Searching for tools and materials is pure waste
Reduced defects	Prevents mix-ups and reduces foreign objects
Reduced breakdowns	Early detection of leaks and cracks during cleaning
Reduced accidents	Prevents tripping, slipping, and collisions
Reduced inventory	Stops buying more when you don't realize you already have it
Improved morale	People want to work in a clean environment

> It also affects hiring. **People who come for interviews judge the factory after seeing it.** In the Busan-Gyeongnam manufacturing industry, securing personnel is important, and the site condition is the company's first impression.

3S Comes First

Trying to do all 5 at once leads to failure. **First, establish 3S: Organization → Neatness → Cleaning**, and then Cleanliness and Discipline will naturally follow.

Common Reasons for Failure

Failure Pattern	Why It Fails
Treated as an event	Only cleaned the day before the boss visits → returns to the original state the next day
Fails to discard	"Maybe I'll need it someday" → warehouse becomes a garbage dump
No on-site participation	Managers give orders, but on-site workers just pretend
No standards	Each person has a different standard for "organized"
No time allocated	Production takes priority, leaving no time for 5S → **Even 15 minutes per week should be scheduled as regular time**

What New Hires Should Do in the First Week

- [ ] Identify **items not used at all in a week** from your workstation
- [ ] Place frequently used tools in **easily accessible places**
- [ ] Make **5 minutes of cleanup before leaving** a habit
- [ ] **Report** any abnormalities (leaks, cracks) found during cleaning

> New hires have an advantage in 5S. **Longtime employees become accustomed to the messy state and don't notice it.** What looks strange to a new person is truly strange. Don't hesitate to speak up.

Sources: Korea Productivity Center — 5S·Workplace Improvement (https://www.kpc.or.kr) · Small and Medium-sized Enterprise and Venture Business Promotion Corporation — Manufacturing Site Innovation (https://www.kosmes.or.kr) · Korea Standards Association — Field Management Practices (https://www.ksa.or.kr)

Tidy up: Remove unnecessary items

Learn how to classify and remove unnecessary items through the red card activity.

The Most Difficult Step Is "Throwing Things Away"

The reason things pile up on site is simple. **It's because there's no authority or criteria for disposal.** Keeping things "just in case they might be needed later" fills up the warehouse.

Judgment Criteria — Frequency of Use

Frequency	Action	Storage Location
Several times a day	Keep nearby	**Within reach on the workbench**
Once a week	Keep close	Shelving inside the workshop
Once a month	Store	Shared warehouse
Unused for over a year	**Review for disposal**	—
Unknown purpose	**Red card**	Isolation area

> If the judgment criteria are **"necessary or unnecessary,"** no one can throw anything away. Change it to an objective standard such as **"whether used in the last X months."**

Red Card Activity

This is a method to **make ambiguous items stand out by attaching a red card** to them.

What to Write on the Red Card

```
┌──────────────────────────┐
│      ● Red Card          │
├──────────────────────────┤
│ Item name :              │
│ Quantity :               │
│ Location found :         │
│ Date attached : 2026-08-04│
│ Reason : □ Unnecessary   │
│         □ Unknown use    │
│         □ Excess stock   │
│         □ Damaged        │
│ Disposal : □ Discard □ Move│
│         □ Return □ Hold  │
│ Judge :                  │
│ Disposal deadline : 2026-09-04│
└──────────────────────────┘
```

Procedure

1. **Define the target area and period** (e.g., Machining Line of Plant 2, first week of August)
2. Participants **attach a red card** to ambiguous items
3. **Gather them in the isolation area (red card corner)**
4. During the set period (usually one month), **observe if anyone comes looking for them**
5. If no one finds them, **dispose of them**

"Isolate first and wait" reduces psychological resistance significantly. If you tell people to throw things away immediately, there will be strong resistance.

Things to Check When Disposing

Item	Caution
Chemicals	Check if it's designated waste (refer to the environment module)
Molds and cutting tools	Might be customer assets — confirm definitely
Drawings and documents	Check preservation period (quality records can be kept for years to decades)
Equipment	Check if registered in the asset ledger, and depreciation
Documents containing personal information	Must be shredded

> **Disposing of customer-supplied molds arbitrarily can cause major problems.** Always confirm molds without asset markings.

Inventory Is Also a Target for Organization

The biggest waste on site is **excess inventory**.

- Not knowing it's already there and ordering again → duplicate inventory
- **Unable to use due to rust, deterioration, or specification changes** during long-term storage
- Consumes space and management costs

Extract a list of **long-term unused materials** and review for disposal, return, or reallocation.

Show the Space Gained Through Organization

The result of organization is **free space.** Take photos before and after, and announce the area gained in numbers to encourage participation.

```
Result of organizing the corridor in Plant 2
  Red cards attached   47 items
  Discarded           22 items
  Transferred to other departments   9 items
  Returned             4 items
  Retained            12 items
  Space gained        18㎡ → used as a temporary storage area for finished products
```

Sources: Korea Productivity Center — 5S Implementation Practices (https://www.kpc.or.kr) · Korea Environment Corporation — Legal Disposal of Waste (https://www.allbaro.or.kr) · Small and Medium-sized Enterprise and Venture Business Promotion Corporation — On-site Innovation Support (https://www.kosmes.or.kr)

Tidy Up: Put Needed Items Back in Their Place

Learn how to create a workplace where "anyone can find what they need within 30 seconds" through visual management, color management, and labeling.

The goal is "Anyone can find it in 30 seconds"

The standard for judging whether things are tidy is one.

> **Can someone who just arrived find it within 30 seconds?**

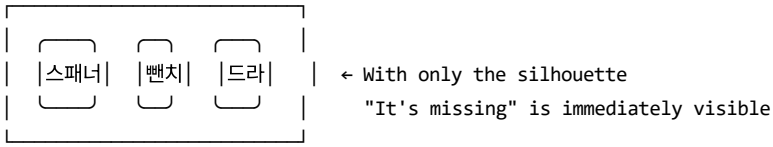
If only veterans know where things are, it's not tidy. When that person goes on vacation, the production line stops.

3定 (Three Fixed) — Principles of Tidiness

Principle	Meaning
정품(定品)	What — clearly specify the product name and specifications
정위(定位)	Where — designated location
정량(定量)	How much — maximum and minimum quantity

Shape Management — Shadow Board

This method involves carving grooves in the board according to the shape of the tool or drawing its silhouette.



The key is that **missing items are immediately visible**. This also prevents accidents caused by placing tools inside equipment and operating it (equipment damage, personal injury).

Color Management

Color is faster than text. It is especially effective in **workplaces with many foreign workers**.

Color	Usage Example
Green	Good product, normal
Red	**Defective, dangerous, prohibited**
Yellow	Hold, caution, passage boundary
Blue	Information, rework

- Use different pallet and box colors per process → prevent mixing
- Use colored stickers for different types of grease → prevent wrong oil use
- Use different colors for shifts → clarify responsibility

Floor Marking (Line Marking)

Marking	Meaning
Passage boundary line	Ensure pedestrian passage
Forklift passage	Separate from pedestrians
Item positioning square	Area for placing pallets and carts
Diagonal line (slash)	**No stacking** — in front of fire extinguishers and electrical panels
Yellow solid line	Equipment operation range

> **Marking fire extinguishers, emergency exits, and electrical panels with diagonal lines** greatly reduces the occurrence of stacking. This is also a space that must be ensured by law.

Labeling Rules

- Use the **same name for everyone to see** (unify internal naming)
- Specify the specification (M8×20 bolt / just "bolt" ×)
- **Multilingual labeling** — Korean + Vietnamese/English, etc.
- Use pictograms in conjunction

Creating a FIFO (First In, First Out) Structure

Tidiness includes **inventory rotation**. If later items are placed in front, old inventory remains.

- Use a roller rack to **put items in from the back and take them out from the front**
- Attach a label with the date of arrival
- Divide the area and classify by week

Maximum and Minimum Indication

Draw **maximum and minimum lines** on the inventory rack.

This alone **automatically determines the order point**. You don't need an inventory management system.

Self-Inspection

- [ ] Are all my tools in their designated locations?
- [ ] Are the labels attached and readable?
- [ ] Are there no items on the passage?
- [ ] Are the areas in front of fire extinguishers and electrical panels clear?
- [ ] If I tell someone who just arrived, "Get me the 3rd spanner," can they find it?

Sources: Korea Productivity Center — Visual Management Practices (https://www.kpc.or.kr) · Occupational Safety and Health Authority — Workplace Passageways and Signage Standards (https://www.kosha.or.kr) · Small and Medium-sized Enterprise and Venture Business

Try this on site

- My Workbench 5S Inspection (5S)
- Practice Writing 5 Red Tags (적카드)

Basic Blueprint Reading

You can only see the site by reading the drawings.

What you will learn

- Understand the basic system rules and projection methods.
- Can read dimension notation and tolerance
- Interpret the surface roughness symbol

Third Angle Projection and Projection Views

Learning the arrangement of front view, plan view, and side view, the principle of Third Angle Projection (제3각법), and the necessity of auxiliary views.

Drawings are the common language of the workplace

If you say "please cut this part by 5mm," people will understand it differently. Drawings are an agreement made so that **everyone who reads it produces the same object**.

Third Angle Projection — the standard in Korea, Japan, and the U.S.

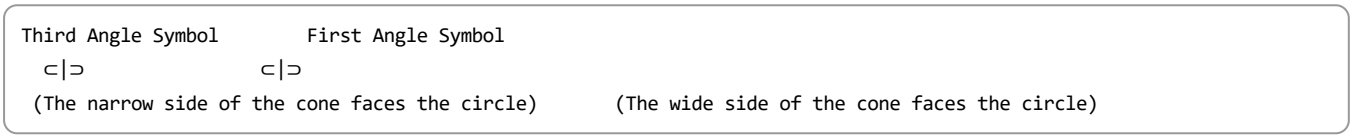
This is a method of arranging a 3D object viewed from multiple directions onto a flat surface. **Place the view where it is seen.**

What is seen from above is placed above, and what is seen from the right is placed on the right. It's intuitive.

It is different from First Angle Projection

Europe and China use **First Angle Projection**, and the arrangement is completely opposite (what is seen from the right is placed on the left). If you misread the drawing, you will end up with **a part that is mirrored left and right**.

That is why the **projection symbol** must always be present in the drawing title block.



> **When you receive drawings from overseas, check the projection method first.** Especially drawings from Chinese and European suppliers often use First Angle Projection.

Line types convey information

Line	Shape	Meaning
Outline	Thick solid line	Visible edges
Hidden line	Dashed line (- - -)	**Parts that are obscured and not visible**
Center line	Dotted line (-·-·-)	Center of circle, hole, or axis of symmetry
Dimension line and extension line	Thin solid line	Dimension indication
Phantom line	Double-dotted line (-··-)	Adjacent parts, moving position
Cutting plane line	Thick dotted line	Location where the cross-section is cut

The more hidden lines there are, the more complex the drawing becomes. That is why cross-sectional views are used.

Cross-sectional View

It shows the inside of an object by cutting it. The cut surface is marked with **hatching (cross-hatching)**.

Type	Purpose
Full section (complete section)	Cut the entire object in half
Half section	Only half of a symmetrical object — shows both exterior and interior at once
Partial section	Only the necessary part
Rotated section	Rotate the cross-section of a rib or boss by 90° for display

> **Do not cut axles, bolts, ribs, keys, or pins vertically.** There is nothing to see inside, and it can cause confusion.

Auxiliary View

When viewed with an orthogonal projection, **inclined surfaces appear distorted.** To see the actual shape, an auxiliary view that is viewed perpendicular to that surface is needed.

Scale

```
1:1   Full size (actual size)
1:2   Reduced scale (drawn at 1/2 of actual size)
2:1   Enlarged scale (drawn at 2 times actual size)
```

Important: Do not measure the size drawn on the drawing with a ruler and use that. **Always follow the dimension numbers that are explicitly written.** There are cases where the scale and actual dimensions differ (NS, Not to Scale).

Title Block — the first place to check

It is located at the bottom right of the drawing.

Item	Reason to Check
Drawing Number and Part Name	To prevent confusion with other drawings
Revision (Rev.) History	**Using an old version can result in total rejection**
Scale	
Projection Method	First Angle / Third Angle
Material	
General Tolerance	Applied to dimensions without individual notation
Author, Approver, Date	

> **Checking the revision number is really important.** It is common for old drawings to be floating around the site, and using them for processing can lead to total rejection. Proper drawing management (only the latest version on site) is the basis of quality.

New Employee Practical Steps

1. **Title Block** — Part name, drawing number, Rev, material, scale, projection method
2. **Understand the overall shape** — Start with the front view
3. **Main dimensions** — Overall length, width, height
4. **Machining areas** — Holes, threads, slots
5. **Identify tight tolerance areas** — These are important dimensions
6. **Read the notes (NOTE)** — Instructions such as heat treatment, plating, burr removal

> **It is common to make mistakes by not reading the notes (NOTE), such as forgetting heat treatment.** Even text in a corner of the drawing is part of the drawing.

Sources: Korea Institute of Standards and Technology — KS B 0001 Machine Guarding (https://www.kats.go.kr) · Korea Industrial Human Resources Development Agency — Mechanical Design and Machining Qualification (https://www.hrdkorea.or.kr) · Korea Polytechnic University — Mechanical Equipment Training (https://www.kopo.ac.kr)

Dimensional notation and tolerance

You will learn how to write dimensions, general tolerances (IT grade), clearance fit tolerances (H7/g6 etc.), and geometric tolerance symbols.

You Cannot Make It Without Tolerance

If it is only written as φ20, it means you must make it exactly 20.000mm, but **that is physically impossible**. That's why tolerance is defined to specify "how much deviation is allowed."

Tolerance Notation

```
ϕ20 ±0.05      →  19.95 ~ 20.05  (symmetrical on both sides)
ϕ20 +0.05/0    →  20.00 ~ 20.05  (only one side)
ϕ20 +0.1/-0.05 →  19.95 ~ 20.10
ϕ20 H7         →  Clearance fit tolerance (see below)
```

The narrower the tolerance range, the more difficult and expensive the machining is. A tolerance of 0.01 is much more expensive than 0.1. Therefore, **areas with tight tolerances on the drawing are functionally important areas.**

General Tolerance (Ordinary Tolerance)

Applied to dimensions where individual tolerances are not specified. Noted in the header as "KS B ISO 2768-m" or similar.

Grade	Tolerance for 30~120mm range
f (precision)	±0.15
m (medium)	**±0.3**
c (coarse)	±0.8
v (very coarse)	±1.2

> Dimensions on the drawing with **no markings are not something you can make however you want.** General tolerance applies.

Clearance Fit — Relationship Between Hole and Shaft

Uppercase = Hole, Lowercase = Shaft. Just remembering this is half the battle.

```
Hole H7  /  Shaft g6   →   H7/g6
```

Type	Relationship	Example	Use
Loose Clearance Fit	Always has clearance	H7/g6, H7/f7	Rotation and sliding (bearing housing, shaft)
Medium Clearance Fit	Clearance or interference	H7/k6, H7/m6	Precision positioning, disassemblable
Force Fit	Always interference	H7/p6, H7/s6	**Press fit** — not disassembled

Practical Feel

- **H7/g6** — Can be inserted and removed by hand, can rotate
- **H7/h6** — Pushed in by hand, not loose
- **H7/k6** — Lightly struck with a wooden mallet
- **H7/p6** — Press fit or heated insertion

> **It is common to make mistakes by trying to force a force fit by hand, damaging the part.** Check the drawing symbol to confirm whether it is a press fit.

IT Grade (Tolerance Grade)

The smaller the number, the more precise.

Grade	Use
IT01~IT4	Gauges
IT5~IT10	**Fit parts**
IT11~IT18	General machining, casting, forging

Even within the same grade, **the larger the dimension, the larger the allowable tolerance.** The tolerance range for φ10 H7 and φ100 H7 differs.

Common Symbols

Symbol	Meaning
φ	Diameter
R	Radius
□	Square
t	Thickness
C	Chamfer 45° (C2 = 2mm chamfer)
⌴	Counterbore (space for bolt head)
⌵	Countersink (space for socket head)
▽	Depth
×	Quantity (4×φ10 = 4 φ10 holes)

Screw Notation

```
M8 × 1.25 - 6H
│  │   │     └ Grade (H = female thread, h/g = male thread)
│  │   └ Pitch 1.25mm
│  └ Nominal diameter 8mm
└ Metric standard thread

M8      → Standard thread (pitch can be omitted, M8 is 1.25)
M8×1    → Fine thread
```

Reference Dimensions and Theoretical Dimensions

- **(20)** in parentheses = **Reference dimension**. Not subject to inspection
- **□20□** with square border = **Theoretical exact dimension**. Used with geometric tolerance, no tolerance applied to itself

Common Mistakes by Newcomers

Mistake	Result
Not checking tolerance and only matching the midpoint	Skewed deviation, rejection
Confusing H7 with h7	Confusion between hole and shaft → Doesn't fit or too loose
Ignoring general tolerance	Rough machining of unmarked dimensions
Measuring the drawing with a ruler and using it	Mismatch between scale and actual dimensions
Using an old drawing	Full rejection

Tips for Setting Target Values

```
If machining ϕ20 +0.03/0  (20.00 ~ 20.03)

The target is not 20.015 (center), but
considering the tool wear direction, 20.02~20.025

→ In cases where the tool wears and the dimension increases as machining continues,
starting on the smaller side allows for longer use
```

Knowing the tool wear direction allows you to last longer within the tolerance range. Be sure to ask your senior.

Sources: National Institute for Standards — KS B ISO 286(Fit) / 2768(General Tolerance) (https://www.kats.go.kr) · Korea Industrial Human Resources Development Agency — Machine Processing Certification (https://www.hrdkorea.or.kr) · Korea Metrology Association — Dimensional Measurement (https://www.kasto.or.kr)

Surface Roughness and Material Marking

Interprets the meaning of Ra (Arithmetic Average Roughness), Rz values, surface roughness according to machining methods, and material symbols (SS400, SUS304, etc.).

Surface Finish Has Grades

Even with the same φ20, **smooth like a mirror** and **rough** have different purposes. If the surface where the seal contacts is rough, oil will leak, and if the sliding surface is rough, wear will occur quickly.

Ra and Rz

```
Ra (Arithmetic Average Roughness): Average height of irregularities — most widely used
Rz (Maximum Height): Highest peak to deepest valley

Approximately Rz ≈ 4 ~ 5 × Ra
```

Surface Roughness by Machining Method

Ra (μm)	Feeling	Typical Machining Method	Usage
12.5	Rough	Rough milling, cutting	Non-contact surfaces
6.3	Normal	Milling, turning	General machined surfaces
3.2	Slightly smooth	Finishing turning/milling	General interference fit
1.6	Smooth	Precision turning, boring	**Bearing housing, seal surface**
0.8	Very smooth	Grinding	Sliding surfaces
0.4 or below	Mirror finish	Lapping, honing, superfinishing	Hydraulic cylinder inner diameter

> **Tolerance and roughness go together.** If the tolerance is ±0.01 but the surface is machined with Ra 12.5, the surface irregularities alone can exceed the tolerance.

Surface Roughness Symbols

```
      Ra 3.2
        ▽          Machining to remove material (cutting, etc.)
       ／＼
      ／  ＼

        ▽          No machining to remove material (as-cast or forged surface)
       (○)

Symbol location = applies to that surface
Symbol in the upper right corner of the drawing = applies to all surfaces (unless individually marked)
```

Reading Material Symbols — Based on KS Standards

General Structural Rolled Steel

```
SS400
||└ Minimum tensile strength 400 N/mm²
|└── Steel
└─── Steel

→ Most common general-purpose steel. Good for welding and inexpensive.
   ※ Recently revised to use yield strength standards instead of tensile strength (e.g., SS275)
```

Machine Structural Carbon Steel

```
S45C
|||└ Carbon
||└── Carbon content 0.45%
|└──
└─── Steel

→ The higher the carbon content, the harder but worse welding properties
   S45C is strengthened through heat treatment and used for shafts and gears
```

Alloy Steel

```
SCM435  : Cr-Mo alloy steel. Bolts, shafts (high strength)
SKD11   : Cold work tool steel. Press dies
SKH51   : High-speed tool steel. Drills, end mills
```

Stainless Steel

Symbol	Features	Usage
SUS304	Most common, non-magnetic	Food, general use
SUS316	Mo added, **corrosion resistance**	Marine, chemical
SUS430	Magnetic, inexpensive	Interior decoration
SUS440C	High hardness	Blades, bearings

> **SUS304 is not attracted to magnets.** If it is attracted, it might be SUS430, or it could be SUS304 with weak magnetism due to work hardening. In shipbuilding and marine parts, **SUS316** is often used due to salt content.

Aluminum

Symbol	Features	Usage
A5052	Formability, corrosion resistance	Sheets, cases
A6061	General-purpose, heat treatable	Structures, machine parts
A7075	**Super duralumin, highest strength**	Aerospace, dies

Aluminum weighs **1/3** of steel but has **twice** the thermal expansion. Temperature control is even more important during precision machining.

Cast Iron

```
FC250   : Grey cast iron. Good vibration absorption → machine bed
FCD450  : Ductile cast iron (nodular). Excellent strength and toughness
```

Checking Habits Before Machining

- [ ] Compare the **material symbol** with the **surface engraving/label on the material**
- [ ] **Separate SUS from general steel tools/workbenches** (if contaminated, it will rust)
- [ ] Use **dedicated tools** for aluminum (steel tools cause chips to stick)
- [ ] If **heat treatment** is specified, check the **machining sequence** (deformation after heat treatment → secondary machining required)

> **After working on SUS, touching general steel in the same place can transfer iron particles to the SUS surface, causing rust.** This is called "contamination," and it is a common cause of claims in shipbuilding and plant deliveries.

Sources: Korea Institute of Standards and Technology — KS D (Metallic Materials) Standards (https://www.kats.go.kr) · Korea Institute of Materials Testing — Material Testing (https://www.ktl.re.kr) · Korea Industrial Human Resources Development Service — Metal Materials Qualification (https://www.hrdkorea.or.kr)

Try this on site

- Practice Reading Three Real-Part Drawing Sheets
- Check drawings after measuring dimensions

Understanding Materials

Basic Metal, Non-Metal, and Plastic

What you will learn

- Distinguish the characteristics of major metal materials
- You can read the material symbols
- Understand the criteria for selecting appropriate materials

Steel Materials

Learn the characteristics and uses of SS400 (structural steel), S45C (carbon steel for machine structures), SCM435 (chromium molybdenum steel), and SUS304/316 (stainless steel).

If the material is wrong, everything else is useless

Even if you perfectly match the dimensions according to the drawing, **if the material is different, that part is defective**. These are the kinds of accidents that actually happen frequently on site.

- Using SS400 in a welded structure causes cracking in the weld area
- **Steel plates without a mill stamp** are mixed into shipbuilding blocks and are all rejected during inspection
- Using SUS304 instead of SUS316 in parts exposed to seawater causes holes to form within a few months (official)
- Quenching S45C on a thick shaft causes **the core not to harden**, and it breaks during use

You don't need to memorize 30 material symbols — **you need to know how to read them**. If you know the rules, you can understand even symbols you've never seen before.

Decoding Steel Symbols

KS symbols are generally structured as **[Material] + [Purpose·Composition] + [Number]**.

S S 4 0 0 | | └┴┴ Minimum tensile strength 400 N/mm² | └──── Structure (general structural use) └──── Steel (steel)

S 4 5 C | └┴ Carbon content 0.45% (specification range 0.42~0.48%) | C = Carbon └──── Steel

S C M 4 3 5 | | | | └┴ Carbon 0.35% (specification 0.33~0.38%) | | | └──── Series number (SCM4xx group) | | └──── Molybdenum (molybdenum) | └──── Chromium (chromium) └──── Steel

S U S 3 0 4 └┴┴──── Steel Use Stainless └┴┘ 300 series = Austenitic (non-magnetic)

Here, **the meaning of the numbers varies by series**.

Series	What the numbers mean	Example
SS, SM, SPFH, etc.	**Strength** (N/mm²)	SS400 = Tensile strength of 400 or higher
S□□C, SCM, SNCM	**Carbon content** (in 0.01% units)	S45C = C 0.45%
SUS	**Series number** (not strength)	SUS304, SUS316

> SS400 is currently being changed to **yield strength-based notation (SS275)** due to recent KS revisions. SM490 used for welded structures is also being changed to SM355. Since old and new symbols may appear together on drawings, check the title block and material test certificate together.

Four Representative Steels

Symbol	Carbon Content (approx.)	Heat Treatment	Weldability	Typical Use
SS400	No specification (usually 0.1~0.2%)	Not done	Good	Frame, bracket, base
S45C	0.45%	**Quenching and Tempering**	Poor (preheating required)	Shaft, gear, pin, mold parts
SCM435	0.35% + Cr·Mo	**Normalizing**	Poor	High-strength bolts, thick shafts
SUS304/316	0.08% or less	Not done (passivation)	Good (special filler)	Corrosion-resistant, hygienic, marine parts

Why SS400 should not be used in welded structures

SS400 has **only upper limits for P and S specified, with no carbon content specification**. Even though it's the same SS400, the carbon content can vary by batch, making it impossible to guarantee the quality of the weld. Therefore, for structures subjected to welding loads, **welding structural rolled steel (SM series)** with specified composition and carbon equivalent is used.

Carbon determines the properties

Carbon is the biggest variable that changes the properties of steel.

Carbon ↑ → Strength ↑ Hardness ↑ Quenching effect ↑ Elongation ↓ Toughness ↓ Weldability ↓ Machinability ↓

Category	Carbon Content	Characteristics
Low carbon steel	Less than 0.25%	Soft and easily bent. **Good for welding**. No quenching
Medium carbon steel	0.25~0.6%	Strength increased through heat treatment. Shafts, gears
High carbon steel	Over 0.6%	Very hard. Springs, tools. **Welding almost impossible**

> **If carbon is less than 0.3%, it won't harden even after quenching.** If a request comes in saying "SS400 part, but make it a bit harder," you should suggest **material change or carburizing**, not quenching.

Carbon Equivalent (Ceq) — the number that determines whether welding is possible

Looking at carbon alone is not enough; alloying elements like Mn, Cr, Mo also negatively affect weldability. This value, **calculated as if it were just carbon**, is called the carbon equivalent. The IIW (International Institute of Welding) formula is the most widely used.

Ceq = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15

Let's try calculating it. (Based on representative composition; actual calculation should be done with measured values from the test certificate)

① Welding structural steel SM355 (C 0.18, Mn 1.40) Ceq = 0.18 + 1.40/6 = 0.18 + 0.233 = 0.41

② Structural steel S45C (C 0.45, Mn 0.75, Cr 0.20, Ni 0.20, Cu 0.30) Ceq = 0.45 + 0.75/6 + 0.20/5 + (0.20+0.30)/15 = 0.45 + 0.125 + 0.040 + 0.033 = 0.65

③ Chromium molybdenum steel SCM435 (C 0.35, Mn 0.75, Cr 1.05, Mo 0.22) Ceq = 0.35 + 0.75/6 + (1.05+0.22)/5 = 0.35 + 0.125 + 0.254 = 0.73

Ceq	Weldability	Typical Preheating
0.40 or below	Good	Usually unnecessary
0.40~0.50	Caution	50~150°C
0.50~0.60	Poor	150~250°C
Over 0.60	Very poor	Preheating over 250°C + post-weld heat treatment (200~350°C, hydrogen release). PWHT (stress relief) may be applied separately depending on the specification

> If you **weld S45C (0.65) and SCM435 (0.73) without preheating**, **cracking is almost certain**. Conditions vary depending on plate thickness, restraint, and hydrogen content of the welding rod, so actual preheating temperature should **follow the WPS (Welding Procedure Specification)**. You must not set it arbitrarily.

SUS304 and SUS316

Item	SUS304	SUS316
Composition characteristics	18Cr-8Ni	18Cr-12Ni + **Mo 2~3%**
Magnetism	None (slightly appears after processing)	None
Chloride resistance	Ordinary	**Strong**
Price	Standard	1.3~1.6 times
Use	Food, general corrosion resistance	Marine, chemical, seawater contact

Mo prevents **pitting** caused by chloride ions. In environments exposed to sea breeze, such as Busan, Geoje, and Ulsan, 304 stainless steel often develops rust spots within a few months. This is why **316 stainless steel is used for ship and marine plant parts**.

> **SUS must be strictly separated from general steel tools and workbenches**. If iron particles are transferred to the surface, rust will start from that spot (contamination). This can become a **claim reason in shipbuilding and plant deliveries**. Grinders, wire brushes, clamps are also kept separately as SUS专用.

When receiving materials, check the following

- [ ] **Engraving/marking** on the actual material matches the specified material on the drawing
- [ ] The **Heat No.** on the test certificate (Mill Sheet) matches the engraving on the actual material
- [ ] If it's a welded structure, **carbon equivalent is present on the test certificate**
- [ ] If it's certified material from a mill or prime contractor, **certification stamp** is applied
- [ ] If the material is to be cut and used in pieces, **marking has been transferred before cutting**

> Cutting removes the engraving from the original plate. If you don't transfer the grade and Heat No. to the remaining pieces, those pieces become **unidentifiable materials** and cannot be used. In block factories with many foreign workers, combining **color tape identification and multilingual labeling** is highly effective.

Sources: Korea Institute of Standards and Technology — KS D Steel Standards (KS D 3503/3752/3867) (https://www.kats.go.kr) · Korean Welding and Joining Society — Carbon Equivalent and Weldability (https://www.kwjs.or.kr) · Korea Testing Laboratory — Metal Material Testing and Analysis (https://www.ktl.re.kr)

Non-ferrous metals

Learn the properties of aluminum (A6061, A7075), copper, brass, and titanium, and the precautions to take when machining them.

It's Not as Easy as It Seems

Non-ferrous metals are softer than steel, so it's easy to think that machining will be easier. In reality, **it's difficult in a different way than steel**. Because it's soft, it sticks to the tool, is sensitive to heat, and is easily bent.

If a new employee makes aluminum parts using the same feeling as when machining steel, the result is usually like this:

- Pass in the morning measurement, but fail in the afternoon measurement (**thermal expansion**)
- Rough surface with inconsistent dimensions (**built-up edge**)
- Thin parts bend immediately after the clamp is released (**low stiffness + residual stress**)

Reading Aluminum Alloy Symbols

The **first digit of the four-digit number** indicates the main alloying element.

A 5 0 5 2 - H 3 2 │ │ │ │ └── Temper Designation (machining and heat treatment state) │ └──────────── 5000 series = Mg (magnesium) series └──────────────── Aluminum

1000 series : Pure aluminum — electricity, chemical 2000 series : Al-Cu (duralumin) — high strength, poor corrosion resistance 3000 series : Al-Mn — formability 5000 series : Al-Mg — corrosion resistance, weldability (ships, sheets) 6000 series : Al-Mg-Si — general-purpose structural material, extrusion 7000 series : Al-Zn-Mg — highest strength (aviation, molds)

Temper Designation O : Annealed (softest) H1x : Work hardened (H32 = work hardened and stabilized) T4 : Solution heat treated + natural aging T6 : Solution heat treated + artificial aging ← maximum strength

Symbol	Tensile Strength (approximate)	Features	Applications
A5052-H32	230 MPa	Excellent formability, corrosion resistance, weldability	Sheet metal cases, ship interiors, tanks
A6061-T6	310 MPa	General-purpose, heat treatable, good machinability	Structural frames, machine parts, jigs
A7075-T6	570 MPa	**Highest strength**, poor corrosion resistance and weldability	Molds, aviation, high-load jigs

> **A7075 is not welded.** Welding causes cracking. When A6061 is welded, the heat-affected zone loses the T6 condition and becomes soft (the strength of the weld joint is about 50-60% of the base material. AWS D1.2 specifies the minimum tensile strength of 6061-T6 as-welded as 165 MPa — about 57% of the base material's minimum of 290 MPa). For aluminum structures that are welded, **5000 series** is the standard.

Three Major Traps in Aluminum Machining

1. Thermal expansion is twice that of steel

Material	Density (g/cm³)	Elastic Modulus (GPa)	Thermal Expansion (10^{-6}/K)	Thermal Conductivity (W/m·K)
Carbon steel	7.85	205	11.7	50
Aluminum	**2.70**	**70**	**23.6**	200
Copper	8.96	120	16.5	400
Brass	8.5	100	20	120
Titanium (Gr.5)	4.43	114	8.6	**7**

Let's calculate how big the difference actually is.

Part length 300mm During machining 20°C → measured at 28°C (8°C increase)

Aluminum: $23.6\times10^{-6} \times 300 \times 8 = 0.0566$ mm Carbon steel: $11.7\times10^{-6} \times 300 \times 8 = 0.0281$ mm
———————————————————————— Difference: 0.029 mm

If the drawing tolerance is ±0.02 mm → Regardless of machining accuracy, it will be rejected due to temperature alone

> For precision aluminum parts, **do not measure them when they are hot right after machining.** Wait until the part reaches room temperature in a 20°C constant temperature room before measuring. Record the measurement room temperature and part temperature as evidence for claims.

2. Built-up edge (BUE) is easily formed

During cutting, the material sticks to the tool tip, creating a **fake edge**. This fake edge grows and then falls off, causing dimensional variation and rough surface.

Symptoms

- Surface is rough like it's torn
- Same program, but dimensions fluctuate by 0.02~0.05mm
- Silver mass attached to the tool tip

Countermeasures

- **Increase cutting speed** (BUE forms easily at low speeds)
- Use a high rake angle aluminum-specific tool (2~3 flute, mirror polished flute)
- Coating is DLC or uncoated. TiAlN coated tools for steel tend to have aluminum sticking well
- Use sufficient cutting fluid (it plays a big role in washing away chips)
- Do not lower feed too much

3. It's easily bent

The elastic modulus is about **1/3 of steel**. With the same cross-section and same force, **it bends 3 times as much**. If you clamp it tightly, it will be machined in that state, and when you release the clamp, it will return to its original shape, causing dimensional deviation. For thin plates and frames, reduce clamping force and increase support points.

Copper and Brass

Type	Representative Symbol	Features	Applications
Pure copper	C1100, C1220	**Highest electrical and thermal conductivity**, very soft	Busbar, electrode, piping
7:3 Brass	C2600	Good formability	Deep drawing parts
Free-machining Brass	**C3604**	**Best machinability** (Pb added)	Automatic lathe parts, fittings
Phosphor bronze	C5191	Elasticity, fatigue resistance	Springs, contacts
Aluminum bronze	C6161	Wear resistance, seawater resistance	Ship bearings, valves

Precautions during machining:

- **Pure copper is sticky.** Chips are long and stick to the tool. Very sharp tools, high speed, and sufficient cutting fluid are needed.
- **High thermal conductivity.** Pure copper is about 8 times that of steel (400 W/m·K), and brass is about 2~3 times (120 W/m·K), so heat escapes quickly during welding and soldering. Preheating is needed.
- **Brass is subject to dezincification corrosion.** If exposed to seawater or softened water for a long time, zinc is lost and it becomes soft like a sponge. This is why accidents occur where ship valves and fittings break by hand. For seawater applications, **dezincification-resistant brass or bronze** should be specified.
- For water supply parts, **lead-free regulations** apply, so C3604 should not be used as a substitute.

Titanium

Grade	Composition	Characteristics
Gr.1 / Gr.2	Pure titanium	Corrosion resistance, formable
Gr.5	Ti-6Al-4V	High strength. Most commonly used

Although it has the strength of steel, its weight is about 60% of steel, and **its seawater corrosion resistance is far superior to stainless steel**. That's why it's used in seawater heat exchangers, desalination equipment, and chemical plants. You often encounter it at plant equipment manufacturers in Changwon and Ulsan.

Machining is difficult.

Thermal conductivity about 7 W/m·K (1/7 of steel, 1/30 of aluminum) → Cutting heat does not escape from the material and accumulates entirely at the tool tip → Tool life decreases rapidly

Countermeasures

- Low cutting speed, sufficient feed (wiping makes it worse)
- Apply cutting fluid directly to the tool tip in large amounts
- The tool should not stop on the material (work hardening)
- Approach it as a "material that does not release heat" rather than a hard material

> **Titanium chips are flammable.** Fine chips and dust are Class D metal fires. Using water or a general ABC fire extinguisher makes it worse. Keep a separate chip container and have dry sand or Class D fire extinguishing agents ready. Magnesium and aluminum dust are the same.

Non-ferrous Machining Checklist

- [ ] Have **dedicated tools for aluminum, copper, and SUS** been separated?
- [ ] Have **precision aluminum parts** been measured after **temperature stabilizes**?
- [ ] If welding aluminum, is **6000 series or 7000 series** specified? (Check design)
- [ ] Has **general brass** been used for **seawater contact parts**?
- [ ] Have **titanium and magnesium chips** been **mixed with general chips**?
- [ ] Have **non-ferrous scraps** been **separated by material**? (Mixing significantly reduces recycling value)

Sources: Korea Institute of Standards and Technology — KS D Non-ferrous Metal Standards (https://www.kats.go.kr) · Korea Institute of Machinery and Materials — Machining Technology for Difficult-to-Cut Materials (https://www.kimm.re.kr) · Occupational Safety and Health Authority — Prevention of Metal Dust Fire and Explosion (https://www.kosha.or.kr)

Plastics and Rubber

Understand the uses and characteristics of major plastic and rubber materials such as ABS, PC, PP, PE, nylon, and silicone.

Plastic Is Not Just Metal

In manufacturing sites, plastic and rubber are used much more than you might think. Machine safety covers, gears and bushings, suit liners, piping, and **almost all seals and O-rings** fall into this category.

The problem is that these materials **fail in completely different ways than metal**.

- Slight temperature increases cause them to lose their shape
- Contact with oil or solvents causes them to swell or crack
- Long-term load causes them to slowly stretch (creep)
- Absorbing moisture causes dimensional changes

Thermoplastic vs. Thermoset

Category	Thermoplastic	Thermoset
When heated	**Melts again**	Doesn't melt, burns
Recyclable	Possible	Not possible
Examples	ABS, PC, PP, PE, POM, nylon, PTFE	Epoxy, phenol, urethane, FRP
On-site use	Parts, covers, piping	Adhesive, molding, lining, small boat hulls

Most on-site processing targets are **thermoplastics**.

6 Major Plastics

Material	Common Name	Continuous Use Temperature (Approx.)	Strengths	Weaknesses	On-site Use
ABS	—	60~80°C	Impact resistance, easy to paint and bond	Weak to UV and solvents	Cases, covers, prototypes
PC	Polycarbonate	100~120°C	**Best in transparency and impact resistance**	Stress cracking from alkali and solvents	Machine safety covers, doors
PP	Polypropylene	80~100°C	Best chemical resistance, floats in water (0.9)	**Breaks at low temperatures**, hard to bond	Chemical tanks, piping, plating tanks
PE	HDPE / UHMW-PE	60~80°C	Low friction, chemical resistance, strong at low temperatures	Low rigidity, creep	Suit liners, guides, cutting boards
POM	Delrin, Duracon	80~100°C	**Dimensional stability + low friction + rigidity**	Weak to acids, hard to bond	Gears, bushings, rollers, cams
Nylon	PA6 / PA66	90~110°C	Good toughness and wear resistance	**Dimensional changes due to moisture absorption**	Gears, slides, cable ties

It's also good to know about special materials.

PTFE (Teflon): lowest friction coefficient, up to 260°C, chemically almost invincible Disadvantage — under load, it slowly compresses (creep) PEEK : up to 250°C, excellent in strength and chemical resistance, very expensive UHMW-PE : ultra-high molecular weight PE. Best wear resistance → mining and port suit liners

> **Continuous use temperature varies by grade.** The values above are approximate for a general idea. When designing or purchasing, always use the values from the manufacturer's data sheet.

Why Do Plastics Keep Changing Dimension?

Moisture Absorption — Nylon's Chronic Problem

Nylon absorbs moisture from the air, and as a result, **it swells**.

Nylon (PA6) bushing, outer diameter φ60.00 mm immediately after machining

After 2 weeks, when taken out to assemble, it becomes φ60.15~60.30 → Doesn't fit into the housing

Cause: Expansion due to moisture absorption (up to 0.2~0.5% depending on conditions) Countermeasures: ① Use pre-moisture conditioned materials before machining ② Allow for wider tolerances when expecting humidity changes ③ Replace critical dimension parts with POM

POM absorbs almost no moisture, making it more suitable than nylon for precision gears and bushings.

Creep — Slowly Stretching Under Load

Metal doesn't permanently deform below the yield point, but plastic **continuously deforms even under weak loads over time**. This is why plastic parts tightened with bolts can become loose after a few months. In fastening parts, insert metal inserts or washers to distribute the pressure.

Residual Stress — Bending After Machining

Materials extruded or injection-molded have residual internal stress. If only one side is machined, the balance is disrupted and it bends. When precision machining thick plates, use the sequence **rough machining → annealing (heating and slow cooling) → finish machining**.

Plastic Machining Tips

- **Heat doesn't dissipate easily.** Thermal conductivity is only a fraction of that of metal, so cutting heat remains and causes melting and sticking. Sharp tools, large rake angles, and air blowing are essential.
- **Do not use cutting oil or cleaning agents on PC carelessly.** Contact with organic solvents can cause invisible micro-cracks that later crack open (solvent cracking). Use only water or designated cutting oils.
- **Clamping marks** remain as is. Reduce clamping force and increase contact area.
- You cannot require tolerances like in metal. Design with the premise that the material moves due to temperature and humidity.

Rubber — There's a Specific Rubber for Oil

Rubber	Symbol	Approximate Operating Temperature	Oil Resistance	Typical Use	Absolutely Not to Be Used
Nitrile	**NBR**	-30~100°C	◎	**Hydraulic O-rings, oil seals**	Brake fluid, outdoor long-term exposure
Ethylene Propylene	**EPDM**	-40~120°C	×	Water, steam, brake fluid, outdoor	**Petroleum-based oil, fuel**
Fluoro rubber	FKM	-20~200°C	◎	High-temperature hydraulic, fuel, chemicals	Low temperature, high-temperature steam
Silicone	VMQ	-60~200°C	Weak	Food, medical, high-temperature static seals	Moving seals (wear), steam
Chloroprene	CR	-35~100°C	○	Dust rubber, belts, hoses	Strong acids
Natural rubber	NR	-50~70°C	×	Dust mounts, linings	Oil, UV exposure

> **NBR and EPDM are exact opposites.** NBR is strong against oil but weak against water and brake fluid. EPDM is the opposite. However, **both are black O-rings**, so they can't be visually distinguished.

Real Accidents That Happen

During hydraulic cylinder maintenance, an O-ring was taken out and used randomly

EPDM was used in the NBR position → Petroleum swells EPDM → After a few days, the O-ring becomes soft and expands → Leak + cylinder disassembly + line stoppage

Opposite accident NBR is used in brake/clutch systems (glycol-based) → Swelling and hardening → brake system leak (direct safety issue)

The solution is simple. Don't store O-rings in their original bags. Instead, **store them in their original packaging with specifications and material marked** in the drawer. Also, record the material in the maintenance log.

Check List

- [ ] Have you confirmed **what liquid this part is in contact with** (oil / water / chemicals / brake fluid)
- [ ] Have you checked the **maximum operating temperature** using the data sheet (don't estimate)
- [ ] If installed outdoors, is the material **resistant to UV and ozone**?
- [ ] Have you avoided using materials with high creep in areas under long-term load?
- [ ] Have you avoided using nylon parts in areas with large humidity changes with narrow tolerances?
- [ ] Are **O-rings and seals stored with their material markings intact**?

Sources: Korea Institute of Standards and Technology — KS M Polymer and Plastic Standards (https://www.kats.go.kr) · Korea Testing Laboratory — Polymer Material Testing (https://www.ktl.re.kr) · Korea Chemical Research Institute — Polymer Material Information (https://www.krict.re.kr)

Try this on site

- Material Symbol Quiz with 30 Questions
- Sample Material Tactile Comparison

Site Communication

Clear communication prevents accidents

What you will learn

- Understand the site reporting system
- Know the Way to Communicate with Foreign Workers

Report / Inform / Consult

Learn the 5W1H principle for reporting to your supervisor, contact immediately when an abnormality occurs, and learn how to consult when it's difficult to make a judgment.

Accidents and claims grow during the "30 minutes of silence"

Big problems that occur on-site weren't large from the beginning. After hearing an abnormal sound and delaying reporting for 30 minutes, 300 defective products are produced, equipment stops, and delivery schedules are delayed.

Most manufacturing in Busan, Ulsan, and Gyeongnam follows a subcontracting structure—prime contractor–first-tier–second-tier. If information delayed by 15 minutes on our line causes a stoppage on the prime contractor line, the entire company bears the responsibility.

> The person trusted on-site isn't someone who doesn't make mistakes, but **someone who speaks up quickly and accurately**.

Horenso — Reporting, Notification, Consultation

Though a Japanese term, this communication framework is widely used in domestic manufacturing sites. The three have different purposes.

Category	Original Term	What	Direction	On-site Example
Reporting (報告)	Hokoku	**Result and progress** of tasks assigned	Me → Supervisor	"Setup of Machine 1 is complete. 3 samples passed."
Notification (連絡)	Renraku	**Facts** that others need to know	Me → All relevant parties	"Machine 3 will be powered off from 12:00 to 14:00."
Consultation (相談)	Sodan	**Seeking opinions** when judgment is unclear	Me → Supervisor or senior colleague	"This dimension is 0.02 out of tolerance. Could you check if it's acceptable?"

Among the three, **consultation** is most often missed. It's common to proceed on one's own judgment and later face full-scale defects. **Asking when unsure is the fastest path**.

3 Principles of Reporting

1. **Start with the conclusion** — Answer "what happened" first, then provide background. If you start with the background, the listener can't make a judgment.

2. **Separate facts from opinions** — Don't mix "a burr occurred" (fact) with "the die is worn" (opinion). Mixing them leads supervisors to make wrong decisions.
3. **Bad news first** — Good news can be delayed, but delaying bad news means losing the time to act.

Assemble sentences using 5W1H

When your mind is cluttered, fill in the six slots and read them in order—it becomes your report.

[Fill in the six slots] When August 4, 09:20 Where Plant 2, Line 3, Press Machine 2 Who Operator Kim OO (Colleague Lee OO confirmed together) What Abnormal noise from lower die, burr on product How much 6 out of 20 recent pieces (30%), burr height about 0.5mm How Line stopped → 6 pieces isolated with red tags → Foreman called

[Read as is for the report] "Checked at 09:20 on Line 3, Press Machine 2 due to abnormal noise. 6 out of 20 recent pieces (30%) had a 0.5mm burr. Line stopped, 6 pieces isolated with red tags. Looks like lower die wear, should I request maintenance check?"

The last line is key. **You must include "What should we do?"** for the report to be complete. If you just state the facts and stop, the supervisor has to ask again, wasting time.

Poor Reporting vs. Good Reporting

Same situation, but one sentence can change the outcome.

① Equipment Abnormality

- **Poor**: "Machine 2 seems a bit off."
- **Good**: "Since 09:20, Machine 2 has been making metal friction noise. Vibration is also higher than usual. Line is stopped now. Should I call maintenance?"
- The poor version lacks **when, what, and current status**, forcing the supervisor to check personally. The equipment keeps running during that time.

② Defect Found

- **Poor**: "A few defects occurred. I fixed them and put them back."
- **Good**: "3 pieces in Lot A-0804 exceeded the outer diameter of φ20.05. The specification is φ20 ±0.03. 3 pieces are isolated, and the previous 50 pieces are being fully checked."
- The poor version **handled it alone**. If reworked items mix with good ones, tracking becomes impossible. If the prime contractor later finds issues, it could lead to a special audit.

③ Delivery Delay

- **Poor**: "I might not meet today's production target."
- **Good**: "Out of today's planned 1,200 pieces, 780 are currently produced. Mold change took 35 minutes, so about 420 are short. If we work overtime for 1 hour, we can meet the target. Would you approve?"
- The good version includes **numbers and alternatives**, allowing the supervisor to make a decision on the spot.

④ My Mistake

- **Poor**: (Say nothing)
- **Good**: "I entered the setup value incorrectly, causing 12 pieces to be out of tolerance. Line is stopped now, and 12 pieces are isolated. Please check during re-setup."
- The later you mention the mistake, the **larger the impact and the more trust is lost**. If you mention it when it's 12 pieces, it's a 12-piece issue, but if you wait a day, it becomes a full lot issue.

Immediate Notification — Situations requiring no hesitation

Situation	When	Who to notify
Injury / Near-miss accident	**Immediately, without fail**	Foreman → Safety Manager
Fire / Smoke / Gas smell	Immediately (shout first)	Everyone + 119
Equipment abnormal noise / vibration / leakage	Immediately after stopping the line	Foreman, Maintenance
Defect found	Immediately upon discovery	Foreman, Quality
Ambiguous specification / unable to judge	**Before proceeding**	Foreman, Quality
Lateness / absence / early departure	Before work starts	Foreman
Affecting prime contractor delivery	Immediately upon confirmation	Foreman → Production Manager

> **Near-miss accidents must be reported even if no one is injured**. Failing to report means the next person in the same spot could be injured.

When reporting via wireless radio or group chat

Shipyards and large factories use wireless radios and group chats. Due to loud noises and unclear text, stricter rules are needed.

- **Start with the call** — "Line 3, Kim OO here. Please respond, Foreman." First, state who is calling whom.
- **Repeat numbers twice** — "Six, 6." In noisy environments, single-digit numbers are hard to hear.
- **Read-back** — When receiving instructions, repeat them back exactly. "Full inspection of previous 50 pieces, correct?"
- **Write down safety instructions** — Verbal instructions alone can lead to differing memories later.

First Week Checklist

- [ ] Confirmed who my direct reporting supervisor is (name, contact)
- [ ] Confirmed who to report to if the foreman is absent
- [ ] Checked the format or group chat for reporting near-miss accidents or equipment issues
- [ ] Assembled a report using the 5W1H six-slot method once
- [ ] Developed the habit of read-back when receiving instructions

Sources: Korea Occupational Safety and Health Agency — Pre-Work Safety Inspection Meeting (TBM) Materials (https://www.kosha.or.kr) · Korea Productivity Center — Field Manager Training (https://www.kpc.or.kr) · Korea Standards Association — On-site Problem-Solving and Reporting Practices (https://www.ksa.or.kr)

Communicating across cultures

Easy Korean, using pictures and photos, translation app, learning the standardization of gestures and signals.

"Yes" does not mean they understood

On shipbuilding, machinery and auto-parts floors across Busan, Ulsan and Gyeongnam, you work alongside colleagues on many visa types — EPS (E-9), work-and-visit (H-2), overseas Korean (F-4), marriage immigrant (F-6).

A colleague who came through the EPS passed the Korean language test (EPS-TOPIK). But that is **textbook Korean**. Shop-floor jargon, clipped speech, the Gyeongsang dialect and dropped honorifics are not on the test.

So when you ask (알겠어요? — "Got it?"), most will answer (네 — "Yes"). **In many cultures people are taught that saying you did not understand is rude.** Take that "yes" as understanding, and you get an accident.

> Confirm a safety instruction not with (알겠어요?) but with **(지금부터 뭘 할 건지 다시 말해주세요 — "Tell me what you are about to do.")**

Six rules of easy Korean

1. **One instruction per sentence** — (이거 치우고 저기 가서 박스 가져와) (X) → (이 상자를 저 선반에 놓으세요.) / (다 하면 저에게 오세요.) (O)
2. **Say the subject** — Korean drops it constantly. (안 돼요 — "no / can't") does not say who or what cannot.
3. **Names, not pointers** — instead of (이거, 저거, 거기 — "this, that, there"), say "machine No. 3", "the blue box".
4. **No negative questions** — to (안 하셨어요? — "Didn't you do it?"), does "yes" mean done, or not done? The answer flips by culture. Ask **(했어요? — "Did you do it?")** instead.
5. **Drop jargon, clipped forms and dialect** — (쫌 마이 갖고 온나 — dialect for "bring plenty") will not get through.
6. **Numbers and units, spelled out** — (한 20개쯤 — "about 20 or so") (X) → (20개 — "20 pieces") (O).

Shop jargon into standard terms

Floor terms that came from Japanese lose not only your foreign colleagues but recent Korean hires too. Use standard terms in work standards and work instructions.

Floor jargon	Standard term
narashi (나라시)	leveling, flattening work
shiage (시아게)	finish machining
kisu (기스)	scratch, blemish
bari (바리)	burr
ura (우라)	back side
nogisu (노기스)	vernier calipers
hamma (함마)	hammer
ppallu (빠루)	pry bar
ashiba (아시바)	scaffolding
demodo (데모도)	helper, assistant worker

Pictures over words — the photo SOP

A text-only work standard does not get read. Read but not understood, it gets skipped. **One photo replaces ten lines of text.**

- **One photo per motion, numbered** — mark the order with numbers and arrows.
- **Put the OK photo next to the NG photo** — "this is wrong" sticks longer than "do it this way".
- **Mark hand positions with a red circle** — above all at pinch points.
- **Labels in three layers** — pictogram + Korean + native language.
- In a hurry, **taking a photo on your phone and showing it** is fastest.

> The shape and color of hazard and PPE signs **are fixed by law.** Do not draw your own — use the standard safety signs distributed by KOSHA, which also come in multilingual versions.

Using a translation app properly

A translation app is a good tool, but **a broken input sentence gives a broken result.**

Breaks the app	Feed it this instead
(그거 좀 빨리 해줘요 — "hurry that up")	(이 작업을 15시까지 끝내주세요. — "Finish this task by 15:00.")
(안전모 안 쓰면 안 돼요 — double negative)	(안전모를 쓰세요. 안전모 없이 들어가면 안 됩니다. — "Wear your helmet. Do not enter without it.")
(바리 좀 따고 — jargon)	(부품 가장자리의 버를 제거하세요. — "Remove the burrs from the edge of the part.")

- **Check with back-translation** — translate the result back into Korean. If the meaning drifted, fix the source sentence.

Call people by their names

"Hey", "you", or calling someone by their nationality is itself a safety problem — when you cannot call a name in an emergency, the instruction does not arrive. On day one, **ask for the name and its correct pronunciation, and use exactly that.** Do not hand out Korean nicknames.

Checklist

- [ ] I know the names and pronunciations of the colleagues I work with
- [ ] I confirm with "tell me what you will do", not (알겠어요?)
- [ ] I checked that my process's work standard contains photos
- [ ] I know where our site's crane signal chart is posted
- [ ] I have practiced the stop and emergency-stop hand signals myself
- [ ] I know the standard terms for the 5 most common pieces of floor jargon

Sources: Ministry of Employment and Labor — Management of Foreign Employment (Employment Permit System) Guidelines (https://www.moel.go.kr) · KOSHA — Safety and Health Multilingual Materials for Foreign Workers (https://www.kosha.or.kr) · Korea Industrial Human Resources Development Agency — EPS Employment Permit System Operations (https://www.hrdkorea.or.kr)

Try this on site

- 5W1H 보고서 1건 작성
- TBM 롤플레이

Career Development and Qualifications

My Growth Roadmap Design

What you will learn

- Understanding the Certification System in the Manufacturing Field
- You can design a career development path.

National technical qualifications

Certified Technician → Industrial Technician → Technician → Senior Technician system, introducing popular manufacturing qualifications (mechanical machining, welding, electrical, quality management).

Qualification Certificates Are Not 'Stock Certificates' But 'Access Permits'

On-site qualification certificates are not proof that you "do well." They prove **you have the right to be assigned to a position**. By law, only qualified individuals can perform certain tasks, and many prime contractors require subcontractors to have a certain number of qualified personnel.

Most manufacturing in the Busan–Ulsan–Gyeongnam region follows a prime contractor–first-tier–second-tier subcontractor structure, so this is not just an individual issue. When renewing internal subcontracting contracts, the condition of "how many qualified personnel are present" can determine **whether a line survives or not**. For new hires, this is often the fastest way to make an impact.

> National technical qualifications have **no nationality restrictions**. Colleagues working on an E-9 visa can also take the exam. While there is a barrier of a Korean language exam, it does not block the qualification itself.

1. There Are 5 Levels, But It's Not a Straight Line

According to the National Technical Qualification Act, the levels are as follows:

Level	Nature	What It Proves
Functionary	Entry	Can perform designated tasks according to standards
Industrial Technician	Intermediate	Practical + basic theory, can judge processes
Technician	Advanced	Standard for design, management, and legal appointment
Master Functionary	Highest Skill	Highest on-site skill + mentoring apprentices and managing processes
Engineer	Highest Professional	Planning, design, supervision, and technical guidance

Although people often say "Functionary → Industrial Technician → Technician → Engineer," **Master Functionary is a branch off this line**. If you want to reach the highest level while continuing hands-on work, become a Master Functionary; if you want to move toward blueprints and documents, go for Technician or Engineer. In the field, Master Functionaries are not treated any worse than Technicians.

2. Eligibility — You Cannot Skip Levels

This is the key point. **You cannot take the Technician exam just anyone.** You need experience or a lower-level qualification to be eligible.

Target Level	By Experience Only	Lower Qualification + Experience	By Education/Course
Functionary	No restrictions	—	No restrictions
Industrial Technician	2 years in similar job field	Functionary + 1 year	Vocational college graduate (expected)
Technician	4 years in similar job field	Industrial Technician + 1 year / Functionary + 3 years	University graduate (expected), 3-year + 1 year, 2-year + 2 years
Master Functionary	9 years in similar job field	Industrial Technician or higher + 5 years / Functionary + 7 years	Industrial Technician or Functionary who completes the Master Functionary course (Polytechnic)
Engineer	9 years in similar job field	Technician + 4 years / Industrial Technician + 5 years / Functionary + 7 years	University graduate + 6 years

Only experience in "identical or similar job fields" is recognized. You cannot take the Industrial Technician exam in the machinery field with 3 years of experience in a warehouse. Experience verification is done through employment certificates and 4 major insurance enrollment records.

The Master Functionary course is not about education requirements but **a door that opens only if you have prior qualifications**. Only those who first obtain Industrial Technician or Functionary qualifications can take the Master Functionary course and gain eligibility.

> Eligibility criteria vary by subject and are subject to revision. Before applying, **check the eligibility requirements for the subject directly on Q-Net (Q-Net)**. If you apply without meeting the qualifications, your pass may be revoked later.

3. Getting a Functionary Certificate First Saves Time

[High school graduate employee · Changwon machining subcontractor · Hired in March 2026]

2026.03 Hired, started work 2026.10 Passed Computer-Aided Lathe Functionary exam ← No exam restrictions, possible in the first year 2027.10 1 year after obtaining Functionary certificate → Eligibility for Industrial Technician exam secured 2028.03 Passed Computer-Aided Machining Industrial Technician exam 2029.03 1 year after obtaining Industrial Technician certificate → Eligibility for Technician exam secured

If the same person tries to take the Technician exam without any qualifications 2026.03 + 4 years = 2030.03 eligibility starts

→ Just obtaining one Functionary certificate in the first year moves the Technician exam date forward by 1 year

The first year after hiring is the most important. At this time, there are no exam restrictions, so **you can take the Functionary exam even without doing anything**. After about 3 years, when you think "maybe I should get a certificate now," the waiting period starts again from that point.

4. Qualifications That Actually Have Value in Manufacturing

Field	Functionary	Industrial Technician · Technician	Master Functionary · Engineer
Machine Machining	Computer-Aided Lathe Functionary, Computer-Aided Milling Functionary	Computer-Aided Machining Industrial Technician, Mechanical Design Industrial Technician, General Mechanical Technician	Machine Machining Master Functionary, Mechanical Manufacturing Engineer
Welding	Welding Functionary	Welding Industrial Technician, Welding Technician	Welding Master Functionary, Welding Engineer
Electrical	Electrical Functionary	Electrical Industrial Technician, Electrical Technician, Electrical Construction Technician	Electrical Master Functionary, Building Electrical Equipment Engineer
Quality	—	Quality Management Industrial Technician, Quality Management Technician	Quality Management Engineer
Industrial Safety	—	Industrial Safety Industrial Technician, Industrial Safety Technician	Mechanical Safety Engineer, Electrical Safety Engineer
Plant Maintenance	—	Plant Maintenance Technician	—
Non-Destructive Testing	Radiation Non-Destructive Testing Functionary, etc.	Ultrasonic · Magnetic · Penetrant Non-Destructive Testing Industrial Technician/Technician	Non-Destructive Testing Engineer

Quality management and industrial safety **do not have a Functionary level**. Since you must start at the Industrial Technician level, if you want to go this route, you must create eligibility through experience or education. Plant maintenance is similar, with **only a Technician level**.

In addition, there are qualifications that are immediately useful on-site.

- **Forklift Driver Functionary** — Used everywhere in logistics and shipping. Forklift driving requires a construction machinery operation license, but **for forklifts over 3 tons, this qualification is effectively the only way** (for under 3 tons, a license can be issued after completing training at a designated institution)
- **Hazardous Material Functionary** — If the storage amount of solvents, cutting oil, or paint exceeds the designated quantity, it becomes a mandatory appointment target
- **HVAC and Refrigeration Machine Functionary**, **Energy Management Functionary** — Responsible for utility equipment

5. Qualifications Become Legal Appointment Requirements

The reason why Technicians and Industrial Technicians are particularly valuable is **because the law requires them**.

Qualification	Connected Position
Industrial Safety Technician · Industrial Safety Industrial Technician	Safety Manager (mandatory for manufacturing companies with 50 or more full-time employees)
Hazardous Material Functionary or higher	Hazardous Material Safety Manager
Electrical Technician · Industrial Technician · Functionary	Electrical Safety Manager (required level varies by equipment capacity)
Energy Management Qualification	Energy Manager

> Appointment criteria vary by industry, company size, and equipment capacity and are frequently revised. To check what appointment obligations your company has, **directly check the relevant law on the National Legal Information Center**.

6. How Are the Exams Conducted?

Level	Written Exam	Practical Exam	Passing Criteria
Functionary	60 multiple-choice questions / 60 minutes	Practical	60 points or higher in both written and practical exams
Industrial Technician · Technician	20 multiple-choice questions per subject (number of subjects varies by field)	Written / Practical / Combined	40 points or higher per written subject + average of 60 points, 60 points in practical
Master Functionary	60 multiple-choice questions	Practical (including written)	60 points or higher in both
Engineer	Short-answer · Essay 100 minutes × 4 sessions	Oral interview	60 points or higher in both

- Many subjects use **CBT (Computer-Based Testing)**, and you can see your pass status right after the exam ends.
- **Written exam results are valid for 2 years from the date of announcement**. Even if you fail the practical exam, you don't have to retake the written exam within 2 years. Many people waste this 2-year period.
- Regular exams are usually held 3–4 times a year, with different schedules per subject. Based on the implementation plan released at the beginning of the year, **plan your schedule for the year in advance**.

7. Common Mistakes New Hires Make

Mistake	Result
Passing the written exam but not taking the practical	After 2 years, you have to retake the written exam
Applying without checking eligibility	Even if you pass, your qualification may be revoked
Starting practical exam preparation after passing the written	Practical exams require time to get used to. Two months is not enough
Not asking about the company's support system	The company may cover the exam fee and training costs, but many pay out of pocket
Pursuing trending qualifications	Qualifications unrelated to your current process do not link to wages or promotions

Checklist for Choosing Your First Qualification Certificate

- [ ] Chose a subject directly related to your process (e.g., lathe operator → Computer-Aided Lathe Functionary)
- [ ] Checked **eligibility** and this year's **implementation schedule** on Q-Net
- [ ] Wrote down the **written exam registration date** and **practical exam registration date** on a calendar
- [ ] If the practical exam is practical-based, asked the team leader if you can practice using the company's equipment
- [ ] Checked if the company has a **support system for exam fees and training costs**
- [ ] Checked the **wage bonus or promotion reflection** for obtaining the qualification in the personnel regulations

Sources: Korea Industrial Human Resources Development Agency — National Technical Qualification Implementation Guidelines (https://www.hrdkorea.or.kr) · National Laws and Regulations Information Center — National Technical Qualification Act and Implementation Regulation (https://www.law.go.kr) · Korea Polytechnic University — Qualification Preparation and Skill Level Course (https://www.kopo.ac.kr)

Career paths

Worker → Team Leader/Section Leader → Plant/Factory Manager or Technician → Quality, Equipment, and Production Technology Experts

"When will this job be over?" — you need an answer

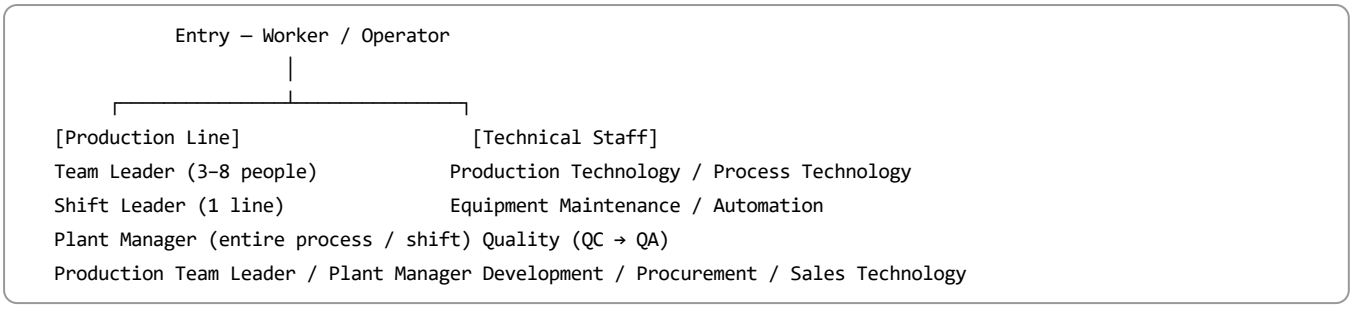
This is the biggest concern that new employees in manufacturing sites have within 1–2 years. When doing the same work repeatedly, it's hard to see where you'll be in 5 or 10 years.

However, looking at the personnel structure in manufacturing sites in Busan, Ulsan, and Gyeongnam, there are actually opportunities. **Most skilled workers are in their 50s or older, leaving a gap in the younger age groups.** A large portion of new

hires are foreign workers, but due to their limited stay period, it's difficult for them to move up to long-term management positions. As a result, **young workers who can give instructions and write documents in Korean are promoted faster than before.**

The problem is that it's not enough to just "stay put and be promoted." There is a clear point where people who move up and those who stay the same diverge.

1. There are two crossroads



The **production line** is the path where you are responsible for people and performance, while the **technical staff** is the path where you solve problems. Neither is better than the other. However, the required skills are completely different.

Category	Production Line	Technical Staff
Core Competency	Personnel allocation, schedule achievement, people management	Drawings, data, equipment principles
Evaluated On	Production volume, delivery time, days without accidents	Reduction in defect rate, equipment operation rate, number of improvements
Favorable Qualifications	Skilled worker, industrial safety, forklift/crane	Technician, quality management, equipment maintenance, CAD/PLC
Bottleneck	Document/data work	Gaining on-site trust

2. Production Line — Requirements change at each stage

Stage	Actual Work	To Move to the Next Stage
Worker	Follow standard operations, report abnormalities, check initial products	Ability to handle 2–3 processes, skilled worker, no absenteeism
Team Leader	Assign work in small groups, train new employees, hand over shift duties	Industrial technician, ability to handle 4M changes, people management skills
Shift Leader	Achieve daily production for one line, assign personnel, approve initial product inspection	Ability to read and explain cost and defect data
Plant Manager	Oversee overall QCD for the process, respond to prime contractor audits, judge equipment investment	Skilled worker/technician, lead document and meetings

The number of years required for promotion varies greatly depending on the company size and vacancy situation. Some small subcontractors with fewer than 50 employees can become shift leaders in 3–4 years, while larger companies may take up to 10 years. **The real variable is whether your name appears as a candidate when a vacancy occurs, not the number of years.**

> People who move up to team leader or shift leader have a common trait: it's not **technical skill**, but **record-keeping**. The person who can explain how many items were made yesterday and why they were delayed is given the assignment.

3. Three paths to switch to technical staff

The general paths to transition to technical roles in the field are these three.

Equipment Maintenance

This is the first role to be called when the line goes down. The entry requirement is **basic knowledge of electricity, hydraulic, and pneumatic systems and the ability to read drawings**. Initially, you start by following the equipment maintenance team

leader and handing over parts. You can obtain qualifications such as equipment maintenance technician, electrical technician, and HVAC/elevator technician.

Quality

You can start if you know how to handle measuring instruments. You progress from vernier calipers → micrometers → height gauges → 3D measuring instruments (CMM). Once you have the qualification of industrial quality technician and understand GD&T, you can move from QC (inspection) to QA (quality assurance). QA is the role responsible for responding to prime contractor audits and writing 8D reports.

Production Technology

This is the role where you read drawings and improve cutting tools and jigs. It involves CAD, cycle time analysis, and process layout. The reason why people from the field have an advantage is **"because they have actually done the work."** Designers understand the inconvenience of not knowing this.

All three paths have the same common entry requirements.

```
Three Common Entry Requirements

1. Can read drawings by yourself          (dimensional tolerance · surface roughness · datum)
2. Has the habit of recording data every day    (checklist · equipment abnormality history)
3. Can create tables and graphs in Excel   (pivot table level is sufficient)
```

Without these three, no matter how fast your hands are, you won't be called for a staff position.

4. Actual movements in Busan, Ulsan, and Gyeongnam

- **Second-tier subcontractor → first-tier vendor → prime contractor.** Since the same process experience is recognized directly, "which prime contractor line you supplied to" becomes the specification during experienced hiring.
- **Shipbuilding equipment → plant → defense.** Welding, non-destructive testing, and painting experience are compatible across industries. It's common to move between Geoje, Tongyeong, and Ulsan.
- **Automotive parts.** Experience with JIS sequential supply and qualification as an internal auditor for IATF 16949 strongly influence job changes.
- **Gyeongnam machinery → smart factory construction personnel.** More cases are emerging where SI companies or equipment manufacturers recruit field workers who have handled MES and equipment data.

Note: Experience is not recognized by "how many years you worked" but by **whether you can prove what you did**. If your employment certificate only lists your position as "production," it will be a disadvantage for both taking exams and changing jobs. Before leaving, **make sure to obtain a career certificate with specific job details**.

5. The 3-year roadmap is planned in reverse

Starting from the front and deciding "what to do" leads to confusion. Set your goal and work backward.

```
[Example] 2nd-tier subcontractor in Changwon automotive parts · 2nd-year in machining · Goal: Team Leader in 3 years

3 years later (2029)  Team Leader
               Requirements: Ability to handle 3 processes + industrial technician + ability to train new employees
                    ↑
2 years later (2028)  Obtain qualification as a computer-aided machining industrial technician
               Written exam in March → Practical exam in June / Prepare for the next session in case of failure
                    ↑
1 year later (2027)  Obtain eligibility = 1 year after obtaining a skilled worker certificate
               + Complete evening CAD/CAM course (Tomorrow's Learning Card)
                    ↑
Now (2026)   Start preparing for the practical exam for computer-aided lathe skilled worker
               + Start recording initial product inspection and measurement data under your name
               + Backup training resources for adjacent process (milling)
```

Drawing it this way shows **what you need to do this month**. This is not a plan of "I will work hard."

6. Five things you need to collect now

Experience is recognized not by time but by **documents**. If you wait until later, it might be too late.

- [ ] **Career certificate** — issued with detailed job descriptions upon leaving the company
- [ ] **Social insurance enrollment records** — original proof of employment duration, issued by the National Pension Service and the National Health Insurance Service
- [ ] **Training completion certificates** — scan and keep all safety and health education, special safety education, and internal technical training
- [ ] **Copies of qualification certificates** — the original can be lost
- [ ] **Notes on your work history** — equipment model names you've worked on, product numbers you've handled, measuring instruments used, and improvement cases. The difference between people who have this and those who don't is significant when writing a resume.

> Even if you don't plan to change jobs, make sure to prepare these. They are also used when you receive a promotion review within the company.

Sources: Korea Industrial Human Resources Development Agency — NCS National Occupational Competency Standards (https://www.hrdkorea.or.kr) · Ministry of Employment and Labor — Vocational Skills Development and Career Development Policy (https://www.moel.go.kr) · Korea Productivity Center — Field Manager Training Program (https://www.kpc.or.kr)

Try this on site

- My 3-Year/5-Year Career Roadmap
- Check the exam schedule for one interested qualification

Part 4

Appendix

Words you will hear on site. Look them up when you do not catch one.

Shop floor glossary

The Korean word is kept because that is what you will actually hear, with the English term and an explanation in English beside it. You can show this page to your team leader as is.

라인 Production Line

English definition of Production Line.

셀 생산 Cell Manufacturing

English definition of Cell Manufacturing.

택트타임 Takt Time

English definition of Takt Time.

사이클타임 Cycle Time

English definition of Cycle Time.

잔업(OT) Overtime

Working beyond the legal working hours (40 hours per week). Pay 150% of the regular wage.

교대근무 Shift Work

A system where work is divided into two shifts (day and night shifts) or three shifts for 24-hour factory operation.

호렌소(보·연·상) Ho-Ren-So

English definition of Ho-Ren-So.

5S 5S

English definition of 5S.

적카드 Red Tag

English definition of Red Tag.

다기능공 Multi-skilled Worker

English definition of Multi-skilled Worker.

제3각법 Third Angle Projection

English definition of Third Angle Projection.

공차 Tolerance

Maximum and minimum allowable dimensional differences. Example: If the dimension is 50±0.1mm, the tolerance is 0.2mm.

GD&T Geometric Dimensioning & Tolerancing

International standard for systematically indicating geometric form tolerance. Uses 14 symbols such as location, circularity, etc.

데이텀 Datum

English definition of Datum.

Ra Arithmetic Average Roughness

English definition of Arithmetic Average Roughness.

CNC Computer Numerical Control

English definition of Computer Numerical Control.

G코드 G-code

CNC machine movement commands. G00 (rapid movement), G01 (straight line cutting), G02/G03 (circular cutting), etc.

M코드 M-code

Auxiliary function commands for CNC machines. M03 (spindle clockwise rotation), M08 (cutting fluid ON), etc.

CAM Computer Aided Manufacturing

English definition of Computer Aided Manufacturing.

황삭 Roughing

English definition of Roughing.

정삭 Finishing

English definition of Finishing.

인서트 Insert

English definition of Insert.

BUE Built-Up Edge

English definition of Built-Up Edge.

TIG Tungsten Inert Gas

English definition of Tungsten Inert Gas.

MIG Metal Inert Gas

English definition of Metal Inert Gas.

비드 Bead

English definition of Bead.

용입 Penetration

English definition of Penetration.

WPS Welding Procedure Specification

English definition of Welding Procedure Specification.

파레토도 Pareto Chart

English definition of Pareto Chart.

어골도 Fishbone Diagram

English definition of Fishbone Diagram.

관리도 Control Chart

English definition of Control Chart.

Cpk Process Capability Index

Process Capability Index (공정능력지수). Indicates the spread position of the process compared to the specification. 1.33 or higher is considered good.

8D 8 Disciplines

English definition of 8 Disciplines.

MSA Measurement System Analysis

English definition of Measurement System Analysis.

FMEA Failure Mode and Effects Analysis

English definition of Failure Mode and Effects Analysis.

PPAP Production Part Approval Process

Mass Production Part Approval Process. In the automotive industry, the process of submitting 18 documents before mass production to obtain approval.

PPE Personal Protective Equipment

English definition of Personal Protective Equipment.

KYT Kiken Yochi Training

English definition of Kiken Yochi Training.

TBM Tool Box Meeting

English definition of Tool Box Meeting.

LOTO Lock Out / Tag Out

English definition of Lock Out / Tag Out.

MSDS Material Safety Data Sheet

Material Safety Data Sheet. A safety information document consisting of 16 items, including the hazardous properties of chemical substances, emergency measures, storage methods, etc.

GHS Globally Harmonized System

English definition of Globally Harmonized System.

아차사고 Near Miss

A situation where an accident almost occurred but no one was injured. According to Heinrich's Law (하인리히 법칙), there is 1 major accident after 300 near-miss accidents.

TPM Total Productive Maintenance

English definition of Total Productive Maintenance.

OEE Overall Equipment Effectiveness

Equipment Overall Efficiency. Operating Rate × Performance Rate × Good Product Rate. If it is 85% or higher, it is world class.

MTBF Mean Time Between Failures

English definition of Mean Time Between Failures.

MTTR Mean Time To Repair

English definition of Mean Time To Repair.

인버터 Inverter / VFD

English definition of Inverter / VFD.

PLC Programmable Logic Controller

English definition of Programmable Logic Controller.

HMI Human Machine Interface

English definition of Human Machine Interface.

MES Manufacturing Execution System

English definition of Manufacturing Execution System.

ERP Enterprise Resource Planning

English definition of Enterprise Resource Planning.

코봇 Collaborative Robot

English definition of Collaborative Robot.

FIFO First In, First Out

English definition of First In, First Out.

안전재고 Safety Stock

English definition of Safety Stock.

WMS Warehouse Management System

English definition of Warehouse Management System.

IATF 16949 IATF 16949

International standard for automotive industry quality management system. ISO 9001 + Automotive-specific requirements.

APQP Advanced Product Quality Planning

English definition of Advanced Product Quality Planning.

4M 변경 4M Change

English definition of 4M Change.

JIT Just In Time

English definition of Just In Time.

SMT Surface Mount Technology

English definition of Surface Mount Technology.

ESD Electrostatic Discharge

English definition of Electrostatic Discharge.

클린룸 Clean Room

Clean room that maintains airborne dust particle count at a certain level or below. Class 100 is 100 or fewer per 1 cubic meter.

수율 Yield

English definition of Yield.

MRP Material Requirements Planning

English definition of Material Requirements Planning.

BOM Bill of Materials

English definition of Bill of Materials.

린(Lean) Lean Manufacturing

English definition of Lean Manufacturing.

VSM Value Stream Mapping

English definition of Value Stream Mapping.

PDCA Plan-Do-Check-Act

English definition of Plan-Do-Check-Act.

블록 Block

English definition of Block.

도크 Dock

English definition of Dock.

선급 Classification Society

English definition of Classification Society.

HACCP Hazard Analysis Critical Control Point

English definition of Hazard Analysis Critical Control Point.

CCP Critical Control Point

English definition of Critical Control Point.

PSM Process Safety Management

English definition of Process Safety Management.

HAZOP Hazard and Operability Study

English definition of Hazard and Operability Study.

Who made this book

BIZ360 supports hiring and training for manufacturers in Busan, Ulsan and Gyeongnam. We run, free of charge, on-site information for 2,000 strong small manufacturers, 50 job-specific training modules, and a settling-in guide for the region.

Web biz360.kr

Settling-in guide biz360.kr/live

Full training material biz360.kr/ojt

Contact biz360.kr/contact

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