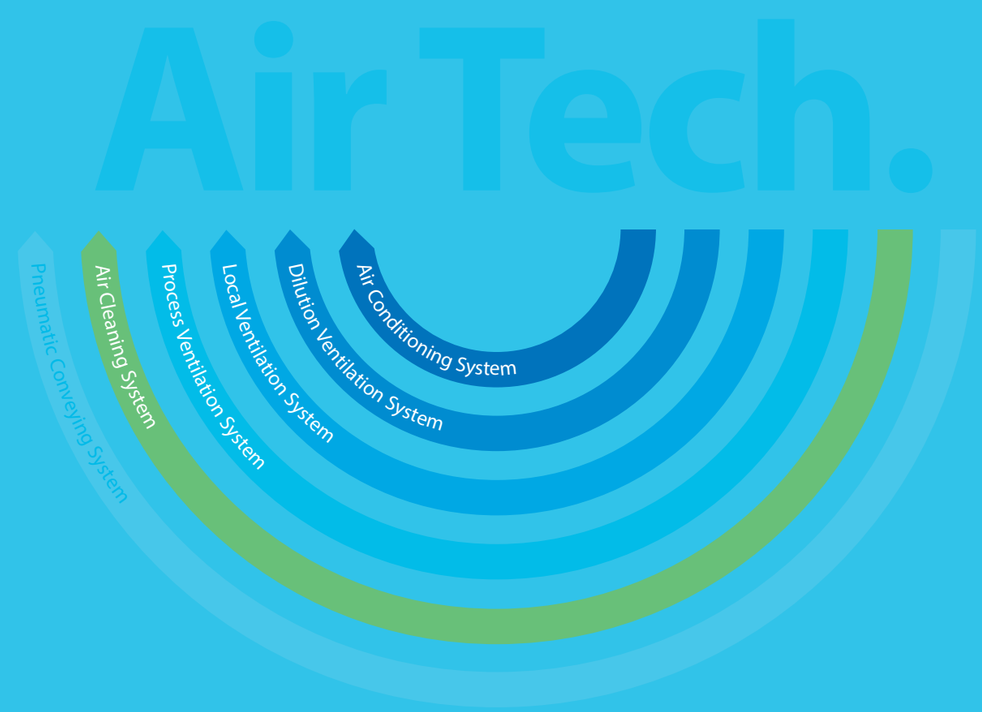
AllsWell

We are making safe spaces to breathe!

Industrial Space

Optimized Customized Solutions

Steel Making Industry



AllsWell
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www.alls-well.co.kr

Leaping

Leaping from South Korea's first professional air technology company to become a world-renowned air technology specialist company.

AllsWell

ALLSWELL Website: http://www.alls-well.co.kr
(Scan the QR code to get connected to the website.)

Established in 2015, ALLSWELL is Korea's first company specializing in air technology and provides customized solutions based on an optimized design given space characteristics and air flow.

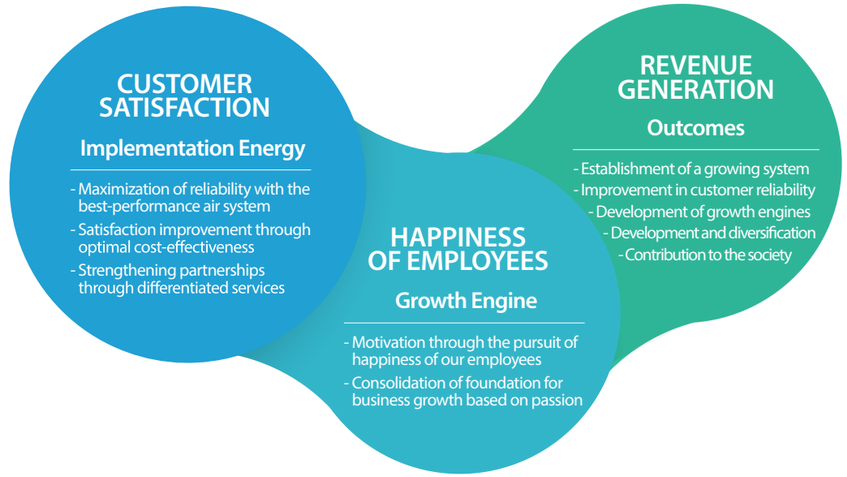
Value and Mission

ALLSWELL protects human life and health by creating space for people to breathe freely.

We put the greatest value on "people." We create a healthy and safe future for humanity with technology for people, and furthermore air technology for the world.

Management Philosophy

A company that contributes to society based on the happiness of its members!
ALLSWELL pursues the "value" of "togetherness."



Thinking

Causes of constant loss of productivity and product failure!
Need a total solution that takes into account the entire space.

Need to eliminate emissions by applying airflow control technology

Emissions are inevitably generated at industrial sites, and accumulated within the facility.
If not controlled properly, various issues such as productivity, product quality, operating costs,
worker safety, and environmental regulations arise. Therefore, accurate management is required.

Necessary

Emissions that create huge risks for businesses!
Need a total solution that takes into account the entire space.

Necessity of Airflow Control in Industrial Sites

- Process emissions are associated with increased product quality issues, reduced productivity, and in addition, it leads to an increase in energy costs.
- By taking into account the physical and chemical properties of the emissions, management and control are necessary in the production process.

If facility emission substances are not removed smoothly from the equipment

- It causes product defects.
- It reduces the operation time due to frequent inspection.

If emission substances are accumulated in the facilities

- It increases the failure occurrence rate due to contamination of the facilities.
- It makes the work conditions unstable due to inconsistent facility performance.

If emission substances are not handled smoothly

- Reduced operating efficiency due to worsening working environment.
- It increases concerns about economic loss due to environmental regulations.

- Loss of productivity
- Increased quality issues
- An increase in operating cost/ energy cost
- Threats to field worker safety/ health
- Economic loss

Total solution that takes into account the entire space from source of pollutant to exhaust air is required

Emissions are inevitably generated at industrial sites, and accumulated within the facility.
If not controlled properly, various issues such as productivity, product quality, operating costs, worker safety, and environmental regulations arise, and management is required.

Responsible

From sources to air emissions, ALLSWELL takes the responsibility for clean industrial sites with industrial air technology.

Air Flow Control Technology

Customer Needs

- Active response to changes in working conditions
- Improving energy efficiency
- Maximizing productivity
- Minimizing maintenance costs
- Response to environmental regulations

AllsWell

Air Technology-based Optimal System Design

Industrial Air Technology (IAT)

Air flow control technology that manages from emission sources in industrial sites to air emissions in exhaust gas

Expected Benefits

- Efficient removal of emissions
  - Lower maintenance costs, improved energy efficiency
- Secure stable working conditions
  - Minimizing the impact of changes in working conditions
  - Providing an active system with static pressure and adjustable airflow
- Improving productivity and reducing defect rate
- Satisfying environmental regulations

Responsibility

Airflow control engineering targets the entire space.

ALLSWELL's differentiation is that it executes airflow control engineering targeting the entire space, designs optimum condition, and focuses on reduction of defect rates, cost reduction,

as well as productivity improvement beyond simple dust collection, ventilation, and purification.

Korea's Only Airflow Control Technology, Manages the Entire Space

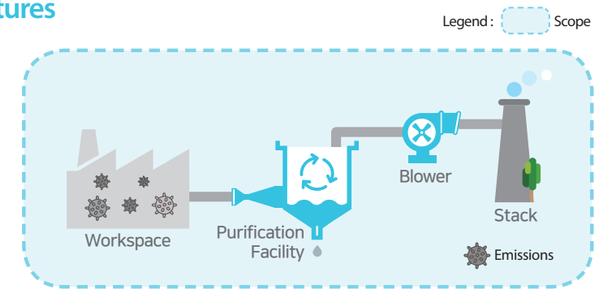
Air flow control engineering must be conducted for the entire space to manage emissions comprehensively and systematically. ALLSWELL is the only company in Korea to have this technology.

Air Flow Control Technology Features

ALLSWELL

Comprehensive response considering the entire space

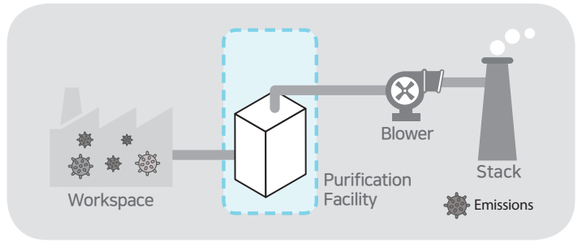
- System design considering emission characteristics and amount
- Control of air quality and emission concentrations throughout the workspace



General

Partial response focused on purification facilities

- Manufacture and installation of purification facilities based on the specified design criteria
- Lack of reflecting internal emission characteristics



Category	ALLSWELL	Existing Companies	Points of Difference
Collaboration Phase	Review Phase	Execution Phase	Planning - Review - Decision - Execution
Design Scope	Process - Facility - Chimney	Facility Consider	Total Space
Process Condition Data	Direct Calculation	Customer Presentation	Utilizing Our Data Base
Facility Specification Data	Direct Calculation	Customer Presentation	Calculated to Meet Customer Needs
Process Warranty	Full Warranty	Partial Warranty	Existing Companies Guarantee Facility Function

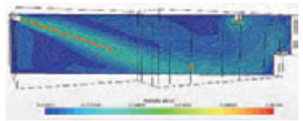
Korea's only "preliminary design technology" (performance assurance design) considering the entire space

Considering Needs and the Entire Space Increase Trust with a Customized System

Using a variety of engineering design techniques for airflow control considering the entire space, it provides accurate and reliable results to meet customer needs.

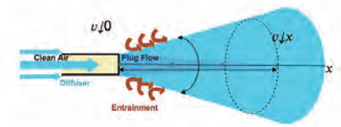
Main Engineering Tools

Airflow Control



- Ventilation: Discharges particulate matters from the target space.
- Dilution: Reduces the concentration of internal particulate matters by introducing clean air into the target space.

Diffuser Design

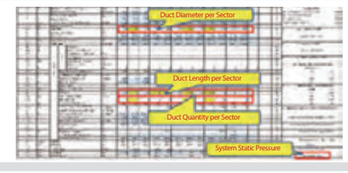


- Optimally feed the air to increase pressure in the target space.
- Design flow rate distribution by distance (movement of emissions along airflow).

Parallel Jet Model

- Considering the airflow and flow velocity in the target space.
- Designing the shape, size, spacing, and air volume of the diffuser.

DSBM

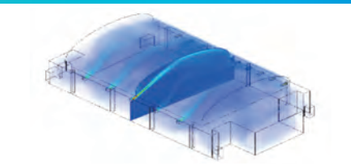


- Calculate optimum system power from the source to the outlet.
- Clearly identify the energy recovery/loss relationship by section.

Hood Design

- Set a mathematical model of airflow movement to capture and remove emission substances.
- Accurately predict changes in target space based on hood shape.

CFD Simulation



- Verification of design feasibility through CFD analysis before construction
- Set analysis conditions reflecting building structure, emission characteristics and surrounding environment

process

Industrial Airflow Control Optimization Process,
Implement Optimization in 4 Stages and 6 Processes

From on-site diagnostics, preliminary design, EPC implementation and performance evaluation to maintenance we operate 4 stages and 6 processes to optimize air flow control in industrial sites.

ALLSWELL's Industrial Airflow Control Optimization Process

Stage	PHASE 1	PHASE 2	PHASE 3			PHASE 4
	On-Site Diagnosis	Preliminary Design	EPC Implementation & Performance Evaluation			Maintenance
	On-Site Diagnosis & Analysis	System Design	Manufacturing Design	Installation/ Construction/ Inspection	Performance Evaluation/ Verification	Maintenance Stabilization
Purpose	On-site data analysis of customer requirements	Basic design for satisfying requirements (Determines 90% of performance)	Detailed design for construction	System installation and operation inspection	Verification and confirmation of the implementation of required performance	Maintaining optimum performance
Main Tasks	- Identifying process/ facility features - Defining customer requirements - External environment analysis - On-site survey and analysis - Data measurement - Identifying problems and drawing solutions	- Building a project team - Cleaning up design elements - Selecting applied technology - Designing overall system - Determining system efficiency - Determining facility specifications - Calculating the estimated amount	- Reflecting detailed data - Production/ Construction drawings - Calculating construction costs	- Selecting contractors - Equipment production - Installation/ Construction management - Conducting a trial run	- Performance evaluation - Effect analysis	- Continuous monitoring - Periodic inspection and test - User training

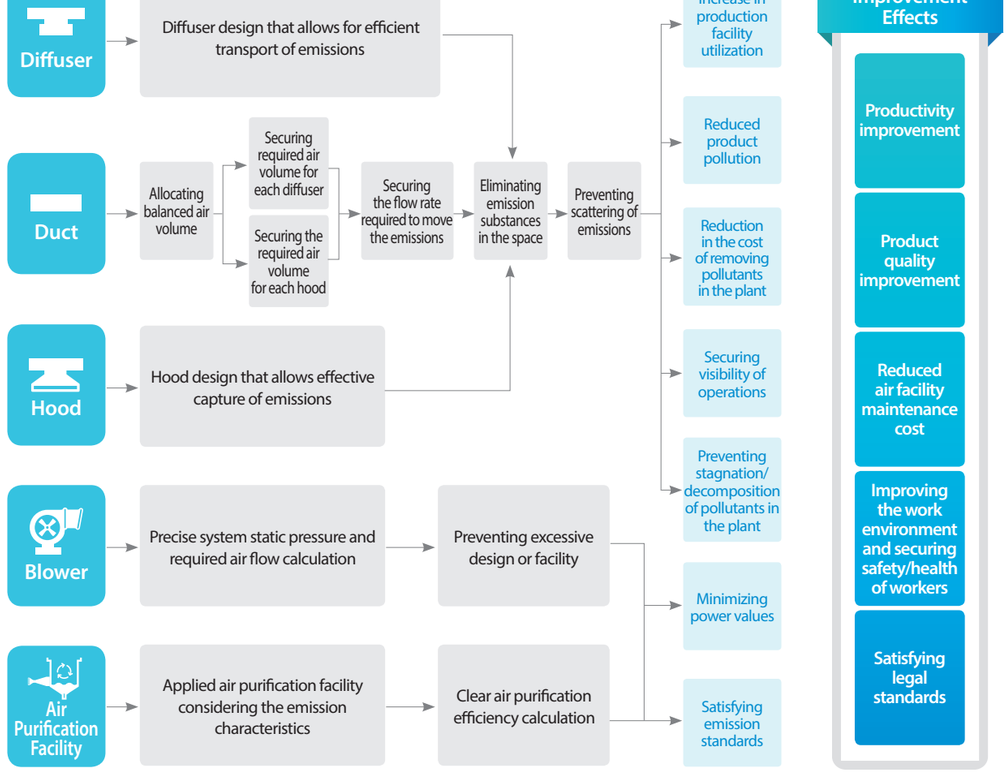
effect

With Airflow Control Technology,
Obtain Economic and Environmental Effects

Applying airflow control technology to industrial sites can improve productivity, improve quality, reduce maintenance costs, ensure worker safety and health, and meet legal standards.

Expected Benefits

Various improvement effects such as increased productivity, quality improvement, and maintenance cost reduction **are** continuously maintained.



May 15, 2019 아시아뉴스통신
Asia news agency

(Scan the QR code to view an article about the Baoshan Steel TCM project in China.)

Precise Air Flow Control Technology
Contributes to Maximizing Industrial Productivity

With the entire space diagnosis and design of the 4th-generation filterless air purification system, ALLSWELL is recognized for its technological superiority in competition with multinational companies and proving its brand power worldwide.

In particular, ALLSWELL has been recognized for its industrial air technology in steel making industry, which has high entry barriers, and its precise air flow control is contributing to productivity improvement at business sites.

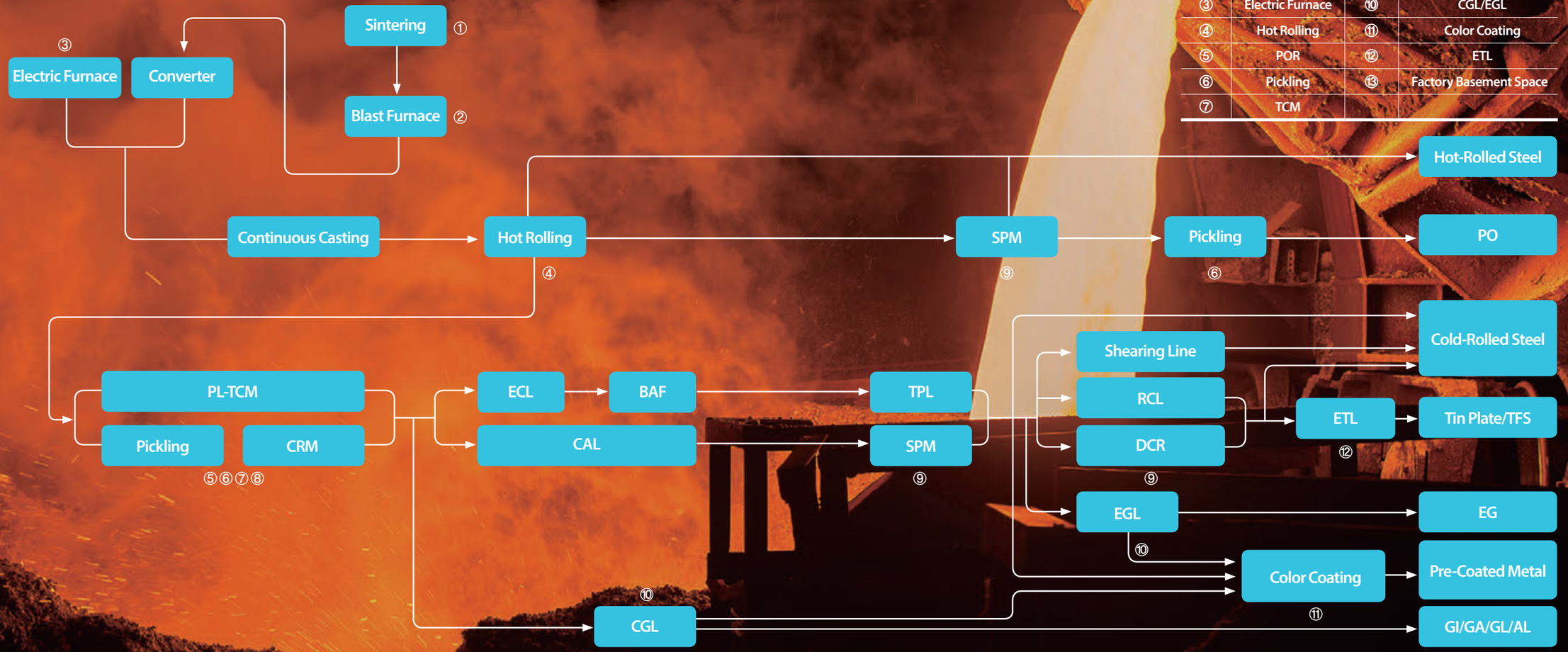
- Entering the Chinese market, which accounts for more than 50% of the world's steel production.
- Korea's first air technology company to enter into technical agreement with all China's top 3 state-owned steel companies specialized in air technology.
- Successfully completed the Tandem Cold rolling Mill (TCM) project of Baoshan Steel, No. 2 (No. 1 in China) steel company in the world.

18 Sintering
20 Blast Furnace
22 Electric Furnace
24 Hot Rolling
26 POR
28 Pickling
30 TCM
32 CRM
34 SPM/DCR
36 CGL/EGL
37 Color Coating
38 ETL
39 Factory Basement Space

Customized Solutions Based on Air Flow Control Technology,

Completely Solves Problems of Process and Facility

To meet customers' needs and completely resolve various problems that occur during all steel manufacturing processes from blast furnace to hot/cold rolling, we provide customized solutions based on air flow control technology for each process and facility.



No.	Process/Facility	No.	Process/Facility
①	Sintering	⑧	CRM
②	Blast Furnace	⑨	SPM/DCR
③	Electric Furnace	⑩	CGL/EGL
④	Hot Rolling	⑪	Color Coating
⑤	POR	⑫	ETL
⑥	Pickling	⑬	Factory Basement Space
⑦	TCM		

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⑬ Factory Basement Space

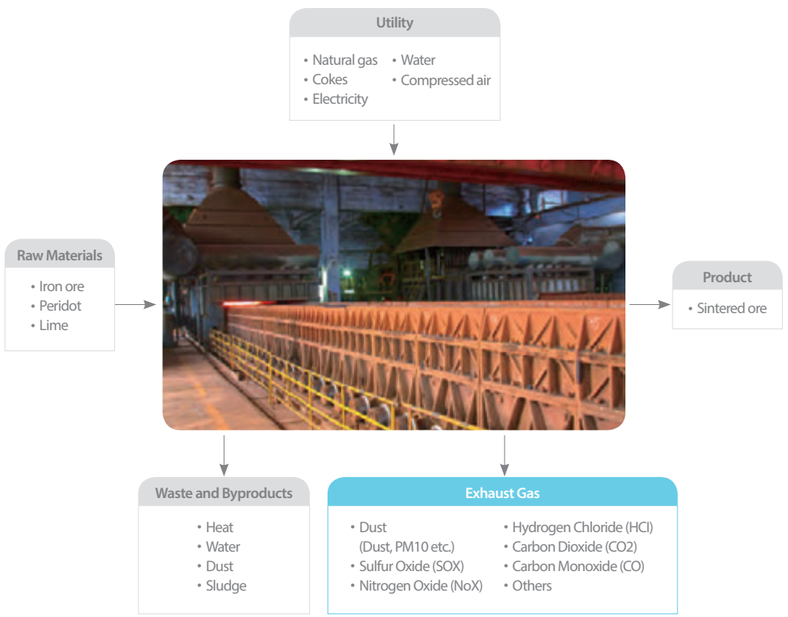
Design a Comprehensive System
from Collection, Transfer, Purification, and Discharge

In consideration of the characteristics of the emissions generated in the sintering process, D-FLES (Dry type Filter-Less fine dust Elimination System) is applied to remove dust using centrifugal force, gravity and friction force without using a filter.

Overview

Major Issues

- Air pollutants such as dust, sulfur oxides and nitrogen oxides during the sintering process
- Emission gas is discharged without proper capture or purification

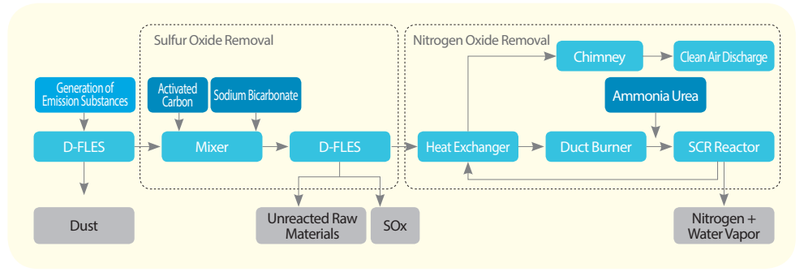


Improvement Directions

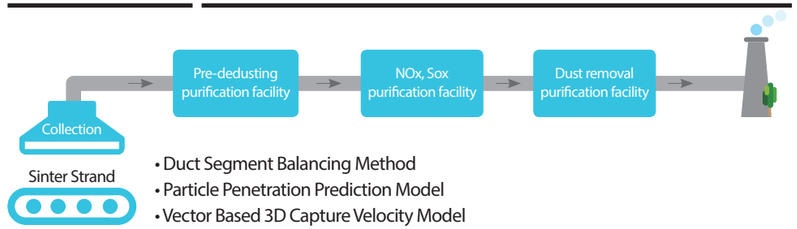
- Diagnose and design to facilitate collection and purification of the exhaust gases in consideration of the emission materials and site conditions
- Applied a system to remove dust without using a filter

Engineering

Status Diagnosis and Design



Major Issues	Major Diagnosis
Scattering in the emission plant	• Calculation of emissions from mass balance analysis of sintering process • Review of air flow control method (considering the type of emission)
Lack of air volume (capture speed) for each hood	• Capture distance and capture speed according to the hood shape • Confirm air flow rate distribution through duct balancing review
Accumulation of emission materials in duct	• Calculate pressure loss of the entire system (hood~chimney) • Compare/Review system curves and blower performance curves • Review duct transfer speed reflecting the characteristics of the emission materials
Exceeded standard emission concentration	• Review purification facility specifications (type, purification efficiency, throughput) considering the amount of emission substances, concentration, and emission standard
Facility aging issues	• Check for abnormal areas (considering emission density, weight, temperature, behavior, etc.) • Check facility contamination, accumulation of foreign substances (checked by equipment, pressure before and after the duct and speed)



- Duct Segment Balancing Method
- Particle Penetration Prediction Model
- Vector Based 3D Capture Velocity Model

Classification	Key considerations	Reflect preliminary design after diagnosis
Emissions	• Predict and consider the generation of dust, sulfur oxides and nitrogen oxide according to process-operating conditions	• Mass/Heat Balance - Calculate the amount - Determine the appropriate capacity of the treatment facility
On-site Conditions	• Analyze the characteristics of emissions (components, density, temperature, etc.), location and form of occurrence	• Hood design considering source location and physical properties • 3D vector velocity calculation
Transfer Route	• Consider the duct transfer speed to prevent air distribution and build-up.	• Duct Segment Balance - Blower static pressure, air volume calculation - Reflect duct route, pressure loss, return speed
Air Purification System	• Application of "filterless air purifier" in consideration of emission characteristics → Minimize maintenance costs → Prevent performance degradation due to blockage and secure stable operating conditions	• Determine facility specifications such as purification efficiency and throughput • System balance calculation

① Sintering
② Blast Furnace
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⑪ Color Coating
⑫ ETL
⑬ Factory Basement Space

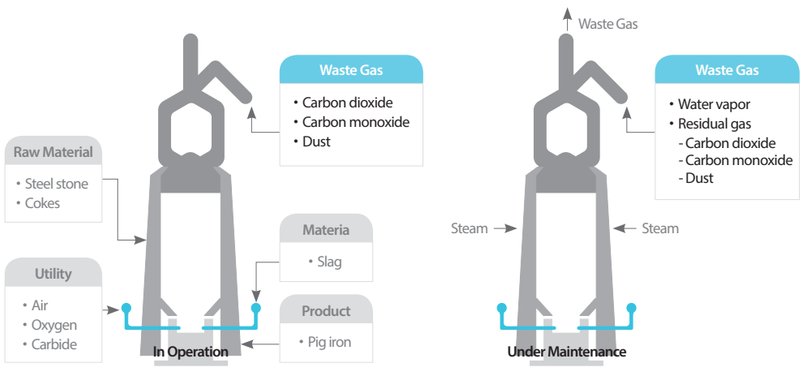
Apply Optimal Cleaning System such as Cyclone and Wet Scrubber

Cleaning systems such as the cyclone method using gravity and centrifugal force and the wet scrubber method removing fine particles are applied depending on the characteristics of the emissions from the blast furnace, and the by-product gas is recycled.

Overview

Major Issues

- Generation of waste gas containing dust during blast furnace operation
- Periodic discharge of gas from inside through safety valve bleeder to prevent explosion during blast furnace maintenance

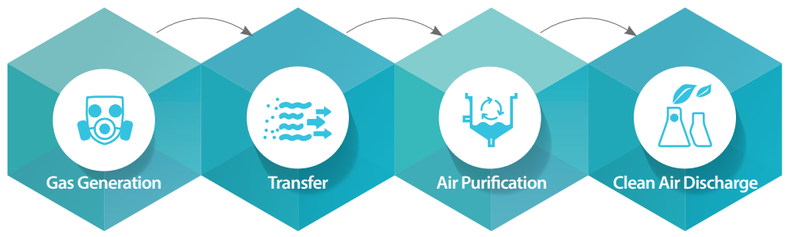


Improvement Directions

- Use cyclone method using gravity and centrifugal force and wet scrubber method to remove fine particles
- Improved removal efficiency by applying multiple dust removal mechanism

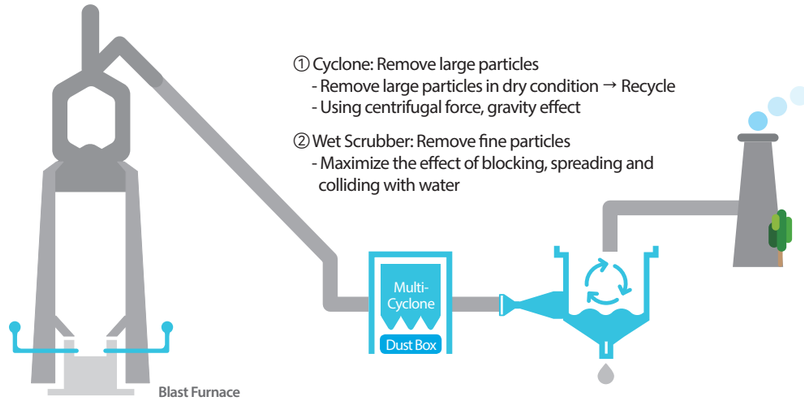
Engineering

Current Status Diagnosis and Design

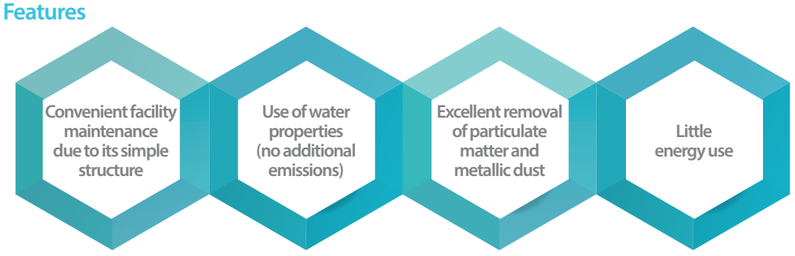


Major Issue	Major Diagnosis
Exceeded standard emission concentration	• Review purification facility specifications (type, purification efficiency, throughput) considering emission level, concentration, and emission standard

Classification	Key Considerations	Remarks
Emissions	Water vapor + residual gas + dust characteristics (Density, etc.)	Removal method
Field conditions	Valve open, Spill types	Collection method
Air Volume	Cleaning throughput	Determination of throughput
Transfer route	Transfer speed and pressure loss and site installation conditions	Duct size
Air purifier	Apply "filterless air purifier" to minimize maintenance costs	D-FLES and W-FLES



Features



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Redesigning the Dust Collector System
Increases System Efficiency to More than 95%

Redesigning the fume dust collecting system in the furnace facility allowed the system efficiency to increase more than 95%, which not only reduces energy costs but also improves productivity by improving the working environment.

Overview

Major Issues

- Sporadic dust generation in electric furnace facilities
- Severe dust pollution and poor working conditions for workers
- Risk of frequent accidents and safety accidents in facilities such as crane/ hydraulic /extra-high pressure due to dust accumulation

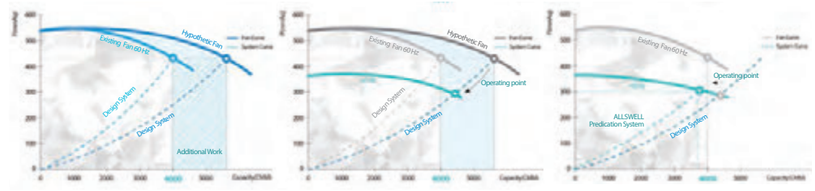
Improvement Directions

- Calculate required air volume considering fume generation and scattering characteristics
- Improved dust collection efficiency by redesigning existing system
- Securing the internal transfer rate inside the duct and preventing accumulation
- Minimize dust accumulation in buildings to prevent facility malfunction and improve working environment

Engineering

Status Diagnosis

Inconsistency between the current fan performance and actual system operation:
Fan overload/accumulation of pollutant in duct/reduced total exhaust air volume



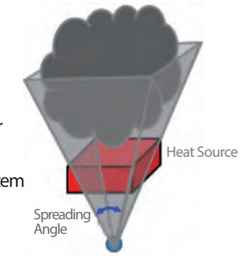
- Design Q : 4000CMM/P : 420mmAq
- Actual Q : Approx. 6000CMM/ P : 420mmAq
- Additional work required/Fan overload
  → Motor Trip occurs

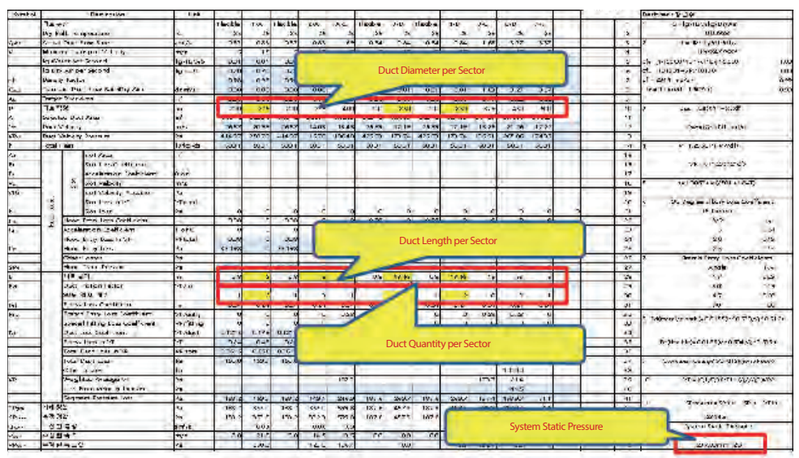
- Reduction of system static pressure through RPM control
- Lower system static pressure than the design system
  → Slow return speed in duct
  → Contaminant accumulation in duct is expected

- Increased system static pressure due to accumulation of contaminants
- Change in system operating point
  → Reduction of total exhaust airflow

Design

- Consider the volume of the fume that diffuses through the heat source
- Increased the dust collection airflow by connecting unused dust collector
- Unreasonable duct line reconstruction of the existing system
- Adjusting airflow balance by facility through redesigning the existing system
  → Fume scatters without introducing new facility by allocating the required air volume for each facility.





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Maximizes the Collection Efficiency of Hot and Humid Dust

It improves the quality and operating environment with an air purifying system that maximizes the collection efficiency of hot and humid dust due to the large amount of fume generated during the hot rolling line process.

Overview

Major Issues

- Hot and humid fume is generated during water spraying to cool steel plates
- Emissions are scattered inside the plant because of the non-closed facility structure due to high temperature working conditions.
- Causing poor quality and facility failure by contaminating the inside of the plant

Improvement Directions

- Applying emission material collection method using push-pull method considering fume scattering form
  → Maximized fume collection efficiency
  → Improved operating environment and product quality
- Applying Filterless Air Purification System → Stable operating conditions

Engineering

Status Diagnosis

Major Issues	Major Diagnosis
Scattering in the emission plant	• Calculation of emissions from mass balance analysis of sintering process • Review of air flow control method (considering the type of emission)
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Accumulation of emission materials in duct	• Calculate pressure loss of the entire system (hood~chimney) • Compare/Review system curves and blower performance curves • Review duct transfer speed reflecting the characteristics of the emission materials

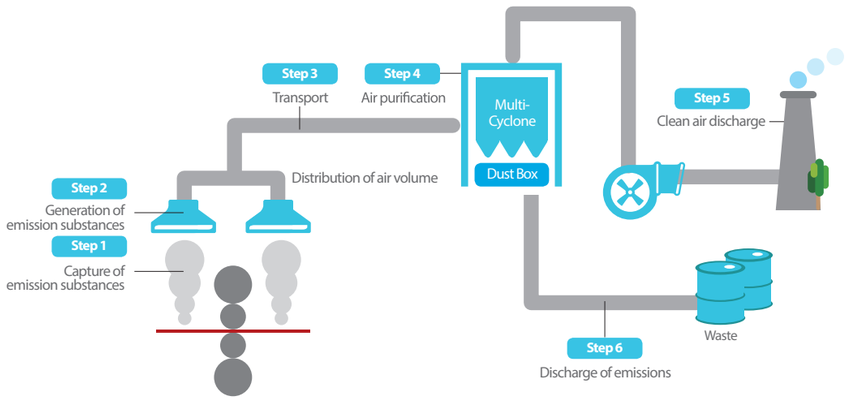
Design

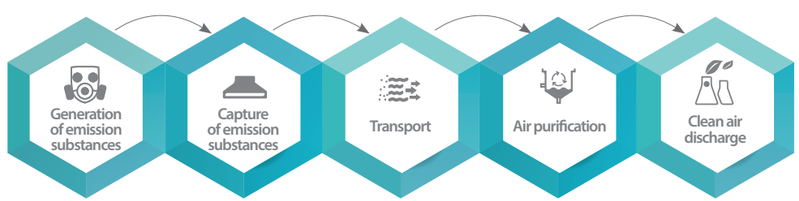
- Local exhaust system (duct, hood) design reflecting on-site conditions
  - Pollutants are generated in many locations and the scattering range is large
    → Minimize fume scattering using the blower(air jet) and guide
  - Air flow design reflecting pollutant characteristics

No.	Item	Guarantee Value	Description	Remarks
1	Capture Speed	1.2~2m/s	Flow rate at hood opening	ACGIH and Korea Occupational Safety and Health Agency standard
2	Feed Speed	10~20m/s	Flow rate in the duct (check gauge)	ACGIH reference

※ ACGIH : American Conference of Governmental Industrial Hygienists

- Applied a filterless air purification system using multi-cyclone





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Air Flow Control Using Air Jet
Improves Dust Collection Performance

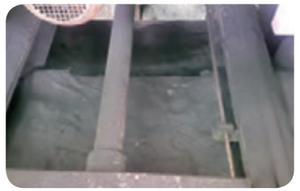
It enhances the collection performance of dust from pay off reel (POR) and scale breaker (tension leveler) and dust generated by moving sheet, improving maintenance cost, productivity, and quality.

Overview

Major Issues

- Pollution inside the plant due to scattering of strip dust
- Equipment failure from contamination due to fume and fine dust





Improvement Directions

- Air flow design considering dust characteristics (density, size, etc.)
  - Air Jet Model, Particle Tracking, Gravity Effect
- Application of the filterless air purification system

Stable Line Operation → **Increased Productivity**

Reduced Dust → **Reduced Defect Rate**

Reduced Facility Pollution → **Reduced Maintenance Costs**

Reduced Pollution Inside the Plant → **Reduced Cleaning Costs**

Engineering

Status Diagnosis

Inefficient Duct and Hood Design → Increased Pressure Loss → Reduced Air Flow → Lower Dust Collection Ability

Hood	Duct Branch	Hood-Duct Coupling Structure
Low collection speed to remove dust due to improper hood design	Uneven balance of quarterly duct pressure is not adequate to distribute the airflow	Reduced blower airflow from increased pressure loss due to improper hood-duct connection structure

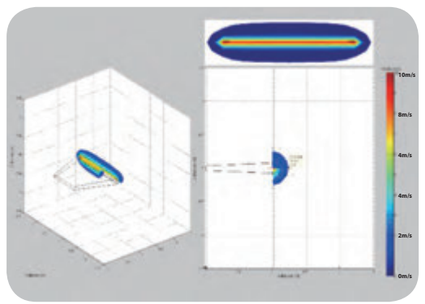
Design

- Add dust removal system using air jet

  Blower, diffuser, and hood are installed in main places where dust is generated, so dust generated during strip movement is moved along the airflow to collect → Minimized dust scattering → Reduced pollution inside the plant

- **Redesigning the duct and hood**
  - Hood shape and size change considering capture speed by distance
  - Change hood position for efficient collection considering dust generation
  - Improved dust removal efficiency by expanding dust capture space
  - Change the duct system to distribute according to the required air volume
  - Minimize pressure loss by changing hood-duct connection structure and expanding part section

  → Reduced blower load and increased air flow



① Sintering
② Blast Furnace
③ Electric Furnace
④ Hot Rolling
⑤ POR
⑥ Pickling
⑦ TCM
⑧ CRM
⑨ SPM/DCR
⑩ CGL/EGL
⑪ Color Coating
⑫ ETL
⑬ Factory Basement Space

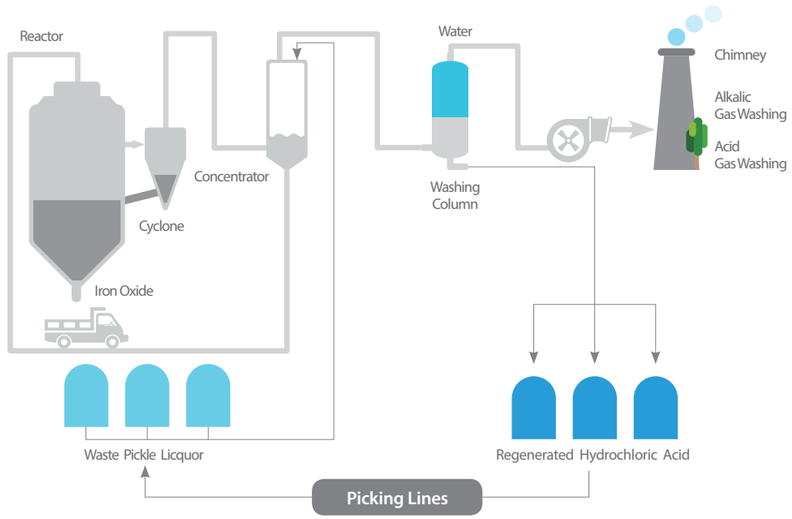
Balanced Design of Duct and Hood Prevents Odor

It accurately calculates the amount of mixed gas generated in the pickling process and designs appropriate throughput to prevent the outflow of harmful substances, contributing to productivity and quality improvement by stabilizing operating conditions.

Overview

Major Issues

- Deterioration of structure and worker efficiency due to scattering of acid vapor
- Emission concentration management required due to tightening environmental regulations



Improvement Directions

- Improve purification efficiency and emission concentration reduction through optimizing operating conditions of existing ARP system
- Accurately calculate the amount of emission substances
  - Calculation of expected air volume through mass balance
- Optimize purification facility
  - Design the processing capacity to reflect diffusion characteristics based on mass transfer
- Duct System Engineering
  - Hood/duct balance design through energy balance

Engineering

Status Diagnosis

Classification	Diagnosis Results
System Balance (Air Volume, Static Pressure, etc.)	Duct flow rate increases due to contamination inside the duct, and the loss of system design pressure changes, so the actual flow rate in the absorption tower exceeds the design criteria (decrease in purification efficiency)
Water Spray	Lack of water spray relative to emissions throughput reduces the efficiency of purifying the absorption tower
Filling	Corrosion and degradation of absorption tower filling due to HCl in the exhaust gas

Design (Example)

The hazardous materials generated are sealed to prevent external leakage and are collected and transferred to and removed from the absorption tower.

Roaster → Cyclone → Venturi Scrubber → Absorber

Item	단위	In			Out			Deviation
		Gas	Liquid	Total	Gas	Liquid	Total	
T	℃	96			86			
P	mbar	967			945			
H2O	kg/h	11,035	14,015	25,050	14,387	10,682	25,069	19
HCl	kg/h	2,200	148	2,348	110	2,163	2,273	-75
FeCl2	kg/h		17	17		17	17	0
FeCl3	kg/h		3	3		115	115	112
NaOH	kg/h			0			0	0
Total	kg/h	27,808	14,183	41,991	29,015	12,977	41,992	

Item	Description
System Material Balance	• Calculation of evaporation of acid and water vapor through mass balance/ Calculation of optimal air flow • Setting internal negative pressure and external positive pressure to prevent leakage of odorous substances
Air Purification Technology	• Calculation of absorption tower capacity through mass transfer calculation • Absorption tower: Removal of odor-causing substances (HCl, H2S04) • Calculation of optimal water spray volume considering exhaust gas throughput
Duct Balance Design	• Energy balance allows accurate calculation of the air flow in individual hoods/ducts • Accurate distribution without damper

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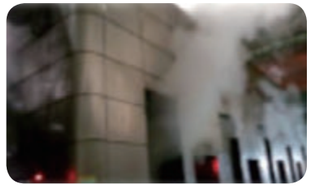
Innovating by Applying 4th-Generation Systems to the TCM

By designing the entire TCM fume elimination system and installing W-FLES, you can expect to improve productivity, reduce product defect rate, minimize maintenance costs, and improve odor problems.

Overview

Major Issues

- Drop of condensate in rolling facility → Increase in product defect rate
- Stagnation/Decomposition of emissions in rolling facilities and systems → Odor generation
- Decreased efficiency of removing emissions from exhaust air
- Inside/Outside facility and wall contamination



Improvement Directions

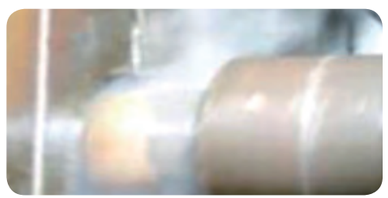
- Optimal air volume design according to pollutant characteristics and production conditions
- Stable operation by applying filterless air purification system

Engineering

Status Diagnosis

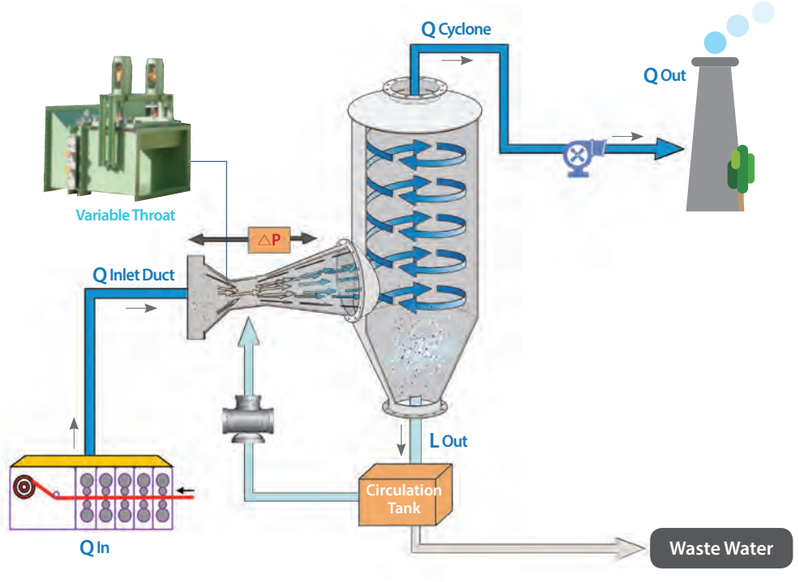
- Fume capture is not smooth
  - Product defects due to pollution in the TCM stand exterior wall and drop of condensate

- Filter blockage occurs
  - Stagnation and decomposition of contaminants in the duct cause system performance degradation



Design

- Predict the contaminant amount by calculating heat generated between the roll and the steel plate
- Calculate material and energy balances throughout the system
- Estimate facility size to maximize purification efficiency due to centrifugal force, gravity, and moisture condensation
- Variable throat configuration with adjustable airflow to actively respond to various operating conditions



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Innovating by Applying 4th-Generation Systems to the CRM

By designing the entire CRM fume elimination system and installing W-FLES, you can expect to improve productivity, reduce product defect rate, minimize maintenance costs, and improve operational efficiency.

Overview

Major Issues

- Drop of condensate in rolling facility → Increase in product defect rate
- Stagnation/Decomposition of emissions in rolling facilities and systems → Odor generation
- Obstruction of vision due to scattering of fume → Reduced operating efficiencyrate

Improvement Directions

- Optimal air volume design according to pollutant characteristics and production conditions
  → Ensure visibility and improve operation efficiency by preventing fume scattering
- Stable operation by applying filterless air purification system

Engineering

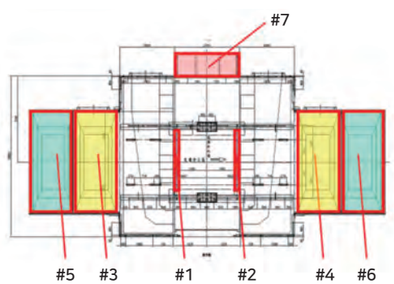
Status Diagnosis

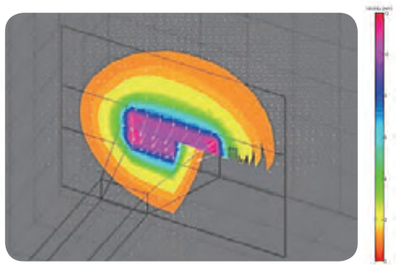
- **Filter-type dust collection facility**
  Apply filter method → Continuous filter blockage → Increased pressure loss (△ P) → Decreased total air flow
- **Blower that doesn't consider the air volume/static pressure**
  Selection of the blower unfit for the entire system & poor performance due to accumulation of exhaust material in the blower (Blade, etc.) → Insufficient blower performance→ Insufficient total air flow
- **Improper use of duct**
  T-shaped branch pipe duct → Unbalance by duct section → Decreased overall air volume and deviation of air volume by hood (left/right)
- **Improper hood structure**
  Uneven surface speed → Narrow capture area & low capture rate → Decreased capture efficiency
- **Absence of screen**
  Condensation due to low temperature ambient air → Generating condensate in the upper part of the hood → Drop of condensate → Product defect

Design

Design duct and hood structures to separate the dust collecting area in detail to distribute the required air volume

Classification	Description
Blower Replacement	Calculation of minimum air flow and static pressure of the entire system to improve fume scattering - Determine the appropriate blower specification for the system
Duct Replacement	Determine the specifications of the duct and branch pipes in consideration of the total air flow rate, air volume distribution by hood, and flow velocity in the duct
Hood Replacement	Hood shape/specification design by calculating fume source, scattering shape/ range, and capture distance and speed
Screen Addition	Minimize condensation by blocking outside air
Purification Facility Replacement	Application of filterless air purification facility to maintain stable working conditions due to consistent volume and no filter blockage





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Innovative Local Exhaust System
Reduces Defect Rate

To prevent loss of productivity and increase in product defect rate from the dust generated in the Skin Pass and Double Reduce Mill processes, the collected dust is discharged as clean air through the purifier by applying a local exhaust system.

Overview

Major Issues

- Insufficient iron dust and byproducts removal → Increased product defect rate
- A lot of auxiliary facilities in the stand → Difficult to maintain
- Inside/Outside facility and wall contamination


Improvement Directions

- Predict iron dust behavior and calculate required air volume by applying the Line Sink Model
- Application of removable hood for simplified maintenance

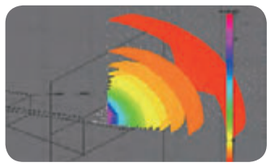

Engineering

Status Diagnosis

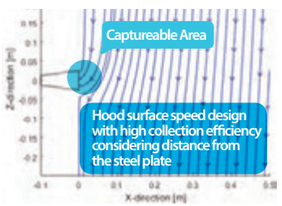
- Insufficient ability to capture iron dust → High defect rate of dull mark
- Difficulty in securing maintenance space due to many auxiliary facilities
- Insufficient air flow by location due to branched duct structure with small diameter
  - Small dust collection area
  - Reduced overall air volume due to the increase in system pressure loss

Design

- Branch duct size-up
  - Reflects the required air volume through duct balancing
- Hood shape improvement
  - Applying the hood optimal shape design for optimal collection efficiency
- Application of movable hood type
  - Application of removable hood type for easy maintenance
- Predict the direction of movement of iron dust and distribution of velocity of ambient air, considering process conditions (line speed)
- Select hood location to maximize the collection efficiency by predicting the movement direction of iron dust
- Calculate the required air volume for each hood considering the occurrence point and moving speed of iron dust

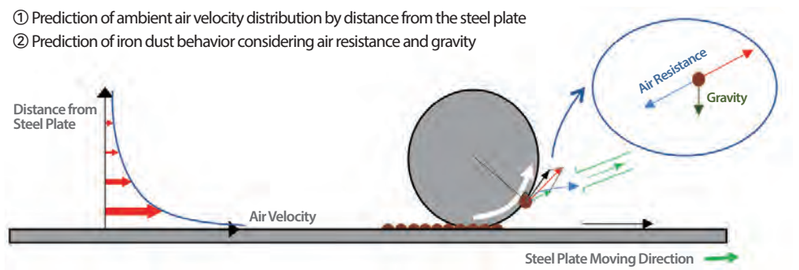


Isokinetic plane for hood capture rate



Collection area according to hood surface speed

① Prediction of ambient air velocity distribution by distance from the steel plate
② Prediction of iron dust behavior considering air resistance and gravity



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Duct Balance Optimal Design
Improves Defect Rate

It solves the problem of defect rate due to water drop by completely removing water vapor generated in the process of drying water-soluble organic films during post-treatment of galvanized steel plate.

Overview

Major Issues

- Steam generation during post-treatment drying process
- Water condensation in the hood due to insufficient water vapor removal
- Reduced productivity from poor performance due to facility contamination

Improvement Directions

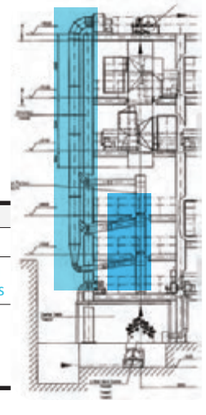
- Redesign the duct line
  → **Optimal vapor capture capacity**
- Calculate the accurate blower constant pressure
  → **Calculation of the appropriate air volume**

Engineering

Status Diagnosis and Design

- Facility for removing steam from the galvanized steel plate after the finishing process of water-soluble organic films
  - Increased organic/inorganic coating volume due to diversified customer requirements
  - Water systems generated during the drying process should be removed quickly and sufficiently
- Due to poor steam removal, water droplets condensed on the surrounding equipment contaminate the surface of steel plates, causing poor quality.

Classification	Description
Composition	Heat treatment - Zinc plating - Temper rolling - Post treatment
Causes of Problem	• Insufficient vapor capture capacity → Poor quality due to steam scattering • Dispersing post-processing organic solvents → Worker safety problems
Improvement Plans	• Distribution diagnosis of installed duct pressure – Reflects the required airflow through duct balancing • Check the consistency with the static pressure of the blower – Select the blower specifications to satisfy the designed air volume



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Improve the Efficiency
by Solving Odor During Color Coating Process

By applying an air purifying system that considers the type and amount of gas in the paint used during the coating process to color the steel plate, it solves the odor problem and improves the operation efficiency.

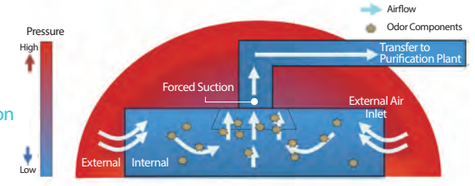
Overview

Major Issues

- Odor scatters inside and outside the plant by gas evaporation in the paint used during coating

Improvement Directions

- Prevents external diffusion through pressure control within space
  - Airflow from outside to inside of space
  - Calculation of appropriate emission amount (capture amount) in consideration of the amount of odor components
- Selection of purification facility capacity and specifications considering characteristics of odor-causing substances



Only external atmospheric pressure > Internal pressure
→ External air come in, and no odor is released

Engineering

Status Diagnosis and Design

- Prevent the spread of odors into and out of the space through pressure control inside the space
- Calculate the amount generated by each component of the emission by analyzing the raw material components
- Estimate air purification method and treatment capacity considering collection amount and odor component characteristics

Applicable Technology	Description
Predicting the amount of emission	• Estimate the amount of emission by analyzing the components of the raw materials • Calculation of air volume to remove odor based on the amount generated
Air Purification Technology	• Absorption tower: N-Butanol removal • Suction tower: Xylen and Naphtha removal
Local Exhaust Technology	• Calculate capture speed of emission substances, deploy hood in optimal position → Minimize inhalation of odors by workers, Prevent scattering outside the workplace
Duct Balance Design	• Calculation of optimal airflow rate by accurate calculation of emission substances • Duct balance design method that accurately distributes calculated airflow without damper

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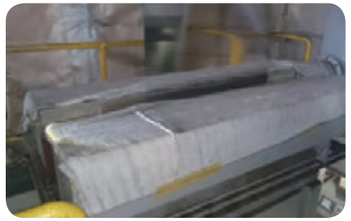
Maximize Oil Mist Collection Performance with Solutions
Using Existing Facilities

The optimal design reflecting the oil mist characteristics of tin plate surface treatment solves problems such as contaminated facilities and limitations of the conventional collector capacity.

Overview

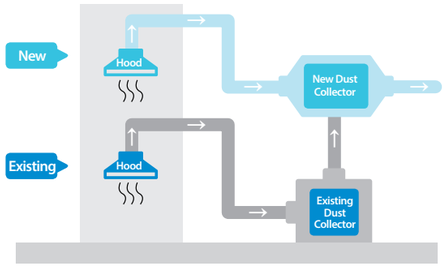
Major Issues



- Scatter the remaining oil mist after oiling the surface of the tin plate
  → Pollution and poor quality of surrounding facilities

Improvement Directions

- Maximize collection performance using existing facilities
  → Prevent contamination of main side facilities by increasing the ability of oil mist collection
  → Improvement of quality problem by oil drop



Engineering

Status Diagnosis and Design

- Lack of local exhaust facility capacity
  - Lack of ability to capture oil mist
  - Airflow increase limit due to the lack of processing capacity of currently installed EP
  - Insufficient space available for installation due to constraints of on-site conditions
- Local exhaust system design reflecting process and characteristics of oil mist generation
  - Oil mist diffuses rapidly into the air due to the high-speed conveyor process
    → Appropriate capture speed and air volume calculation

Occurrence of Hazardous Substances	Contents	Capture or Control Speed
In case of active scattering of hazardous materials in working areas with rapid air movement	Spray painting, Dipping painting, Crushing operation of conveyor drop, Crusher	1.0~2.5m/sec

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Duct Line Redesign and New Air Supply Line Increase Summer Work Efficiency

The design considers the characteristics of underground spaces that are difficult for natural ventilation to reduce the concentration of pollutants in the space and provide a pleasant working environment in the summer.

Overview

Major Issues

- Unreasonable airflow and ventilation structure
  → Rise in emission concentration
- Rise in summer temperature
  → Poor workability

Improvement Directions

- External air supply into the basement
  → Optimal air volume and structure design
- Concentration decreases due to dilution of internal emissions (e.g. acid vapors and odors)
- Temperature drop and work environment improvement in basement interior through the application of air conditioning technology

Engineering

Status Diagnosis and Design

- Provide sufficient clean air and dilute with contaminated air to lower emissions to the desired concentration
- Realization of optimal ventilation efficiency against investment cost by calculating feed/exhaust volume through material and energy balance