ALUMINUM EXTRUSION MOLD LIQUID NITROGEN COOLING SYSTEM

Brief Introduction

Best LN2 Application System in Korea

CVS has committed itself to developing machines for beverages and aluminum extrusion mold cooling systems with experience in developing various beverage-related equipment and technologies that require high vacuum insulation for extended periods of time

Founded in

2009

Design, R&D, Manufacture

- LN2 Doser
- Aluminum Extrusion Mold Liquid Nitrogen Cooling System
- Mini LN2 Doser
- Relief Valve, Vacuum Pipe

Headquarter Located in

14-8, Gimpo-daero 1750beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Republic of Korea, CVS Co., Ltd.

History of CVS

2010

Wooil Beverage Co., Ltd.
2 LN2 Doser
Production and Installation

2011

OKF Co., Ltd.
2 LN2 Doser
Production and Installation

2012

OKF Co., Ltd.
LN2 Doser
Production and Installation

2013

China Taiyuan
LN2 Doser
Production and Installation

Coca-Cola Korean drink
LN2 Doser
Production and Installation

2014

China Hebei Province Langfang Sunrise
LN2 Doser
Production and Installation

OKF Co., Ltd.
LN2 Doser
Production and Installation

2015

OKF Co., Ltd.
2 LN2 Doser
Production and Installation

Dongwon F&B
2 LN2 Doser
Production and Installation

2016

China Hebei Province Langfang Sunrise
LN2 Doser
production and installation

Wooil Beverage Co., Ltd.
2 LN2 Doser
Production and Installation

OKF Co., Ltd.
LN2 Doser
Production and Installation

2018

Daeil Co., Ltd.
US CRYOTEHCH Doser Repair

Okdong Co., Ltd.
Aluminum Extrusion Mold Liquid Nitrogen Cooling System
production and installation

2019

Dawon Light Metal
Aluminum Extrusion Mold Liquid Nitrogen Cooling System
production and installation

Korea Telecommunications Research Institute
Manufacture and installation of HALT equipment liquid nitrogen supply pipe

Linno Aluminum Co., Ltd.
Aluminum Extrusion Mold Liquid Nitrogen Cooling System
production and installation

2020

Naturecell Co., Ltd.
2 LN2 Doser
Production and Installation

Ilhwa Co., Ltd.
LN2 Doser
Production and Installation

O2 Healthcare
5HEAD Liquid Oxygen Doser and Vacuum Pipe

Korea Aerospace Industries
Vacuum Pipe
Production and Installation

2021

Daeju Industry
LN2 Doser
Production and Installation

Hite Jinro
Lab use LN2 Doser
Production and Installation

Prax Coffee
LN2 Doser
production and installation

OKF Co., Ltd.
LN2 Doser
Production and Installation

Certification

특허증
CERTIFICATE OF PATENT

특허 Patent Number 제 10-1878283 호

출원번호 Application Number 제 10-2017-0160025 호
출원일 Filing Date 2017년 11월 28일
등록일 Registration Date 2018년 07월 09일

발명의 명칭 Title of the Invention
알루미늄 압출 금형 액체질소 냉각 시스템

특허권자 Patentee
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위의 발명은 「특허법」에 따라 특허등록원부에 등록되었음을 증명합니다.
This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.

2018년 07월 09일

특허청
Korean Intellectual Property Office

특허청장
COMMISSIONER,
KOREAN INTELLECTUAL PROPERTY OFFICE

Aluminum Extrusion Mold Liquid Nitrogen Cooling System
Patent No. 10-1878283

특 허 증
CERTIFICATE OF PATENT

특 허 제 10-1279304 호 (PATENT NUMBER)
출원번호 (APPLICATION NUMBER) 제 2011-0060541 호
출 원 일 (FILING DATE:YY/MM/DD) 2011년 06월 22일
등 록 일 (REGISTRATION DATE:YY/MM/DD) 2013년 06월 20일

발명의명칭 (TITLE OF THE INVENTION)
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특허권자 (PATENTEE)
등록사항란에 기재

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(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE KOREAN INTELLECTUAL PROPERTY OFFICE.)

2013년 06월 20일

특허청장 김 영

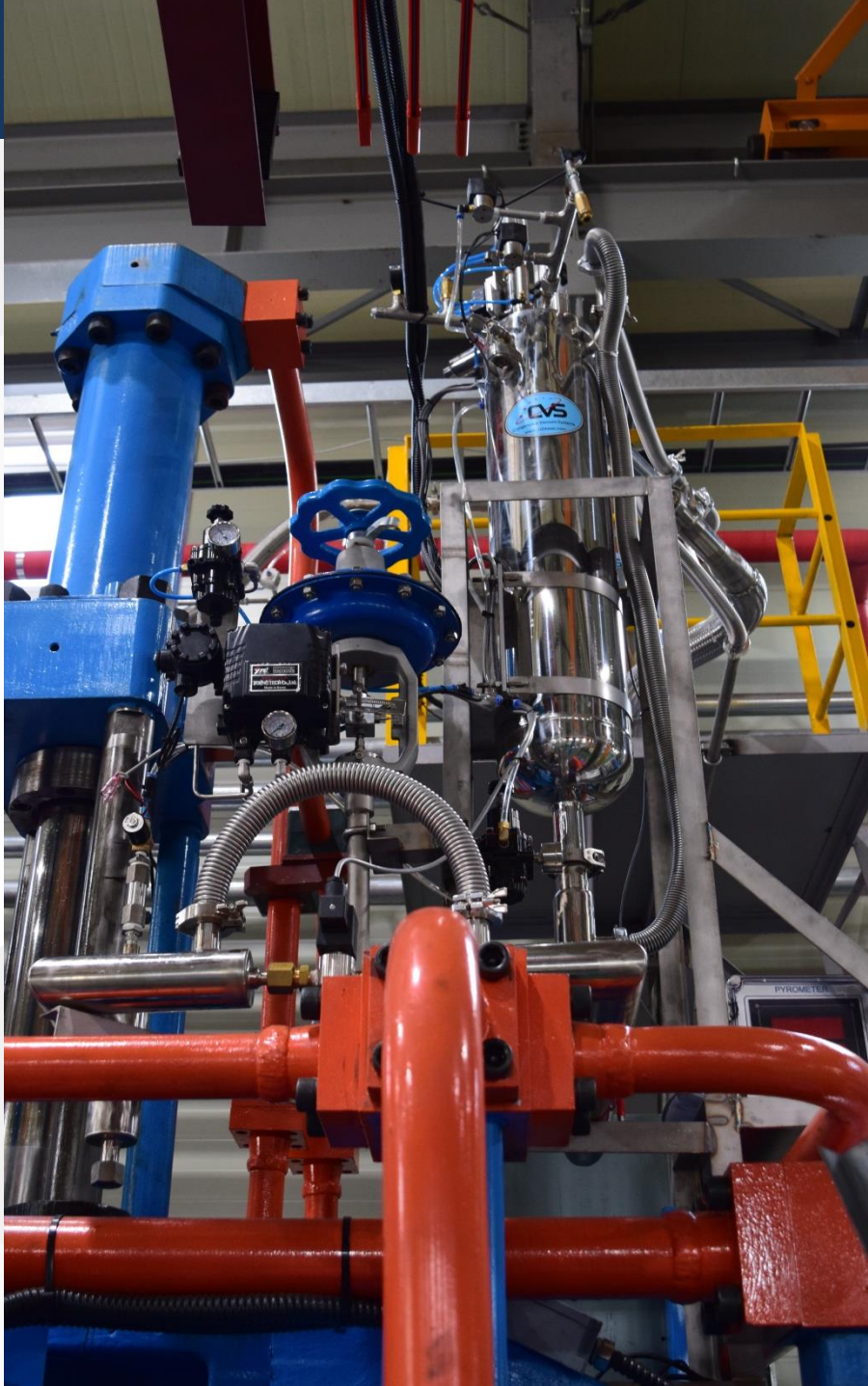
Double Head Liquid Nitrogen Doser Device
Patent No. 10-1279304

01. Aluminum Extrusion Mold Liquid Nitrogen Cooling System Overview

CVS' aluminum extrusion mold LN2 cooling system is a system in which a proportional control valve supplies the liquid nitrogen via a temperature controller connected with an infrared thermometer. The system supplies the liquid nitrogen when the mold temperature rises due to the frictional heat given off from between the billet and the mold bearing surface.

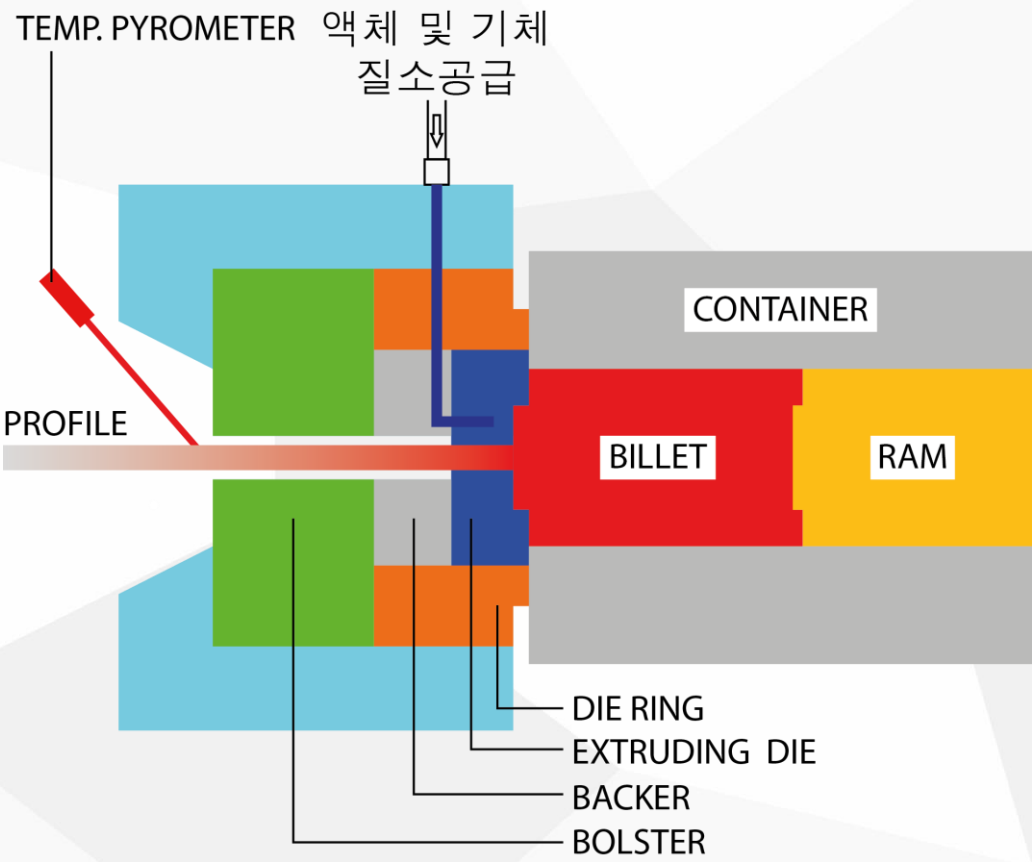
When gaseous nitrogen is supplied in the acceleration process and the mold temperature rises from the frictional heat in the constant velocity process, liquid nitrogen is supplied by the system, freezing the extrusion mold.

Constant temperature of the bearing surface of the mold is maintained in order to improve the quality and productivity of the product surface.

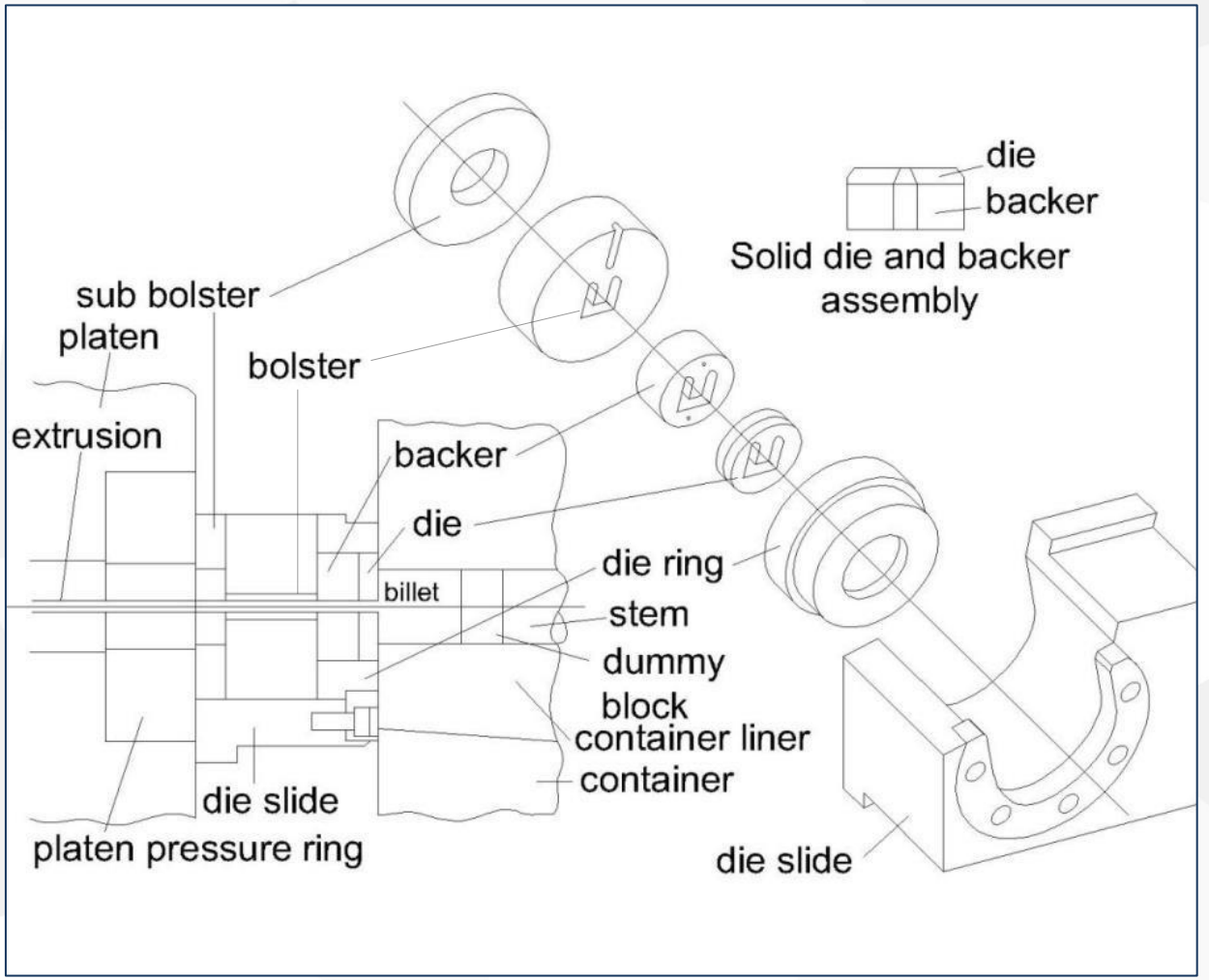


02. Problems and Improvements in the Aluminum Extrusion

Problems (Control Points)	Improvements
Billet Heating Temperature	Uniform Temperature Control
Mold Preheat Temperature	Temperature Control for Each Material
Friction Heat Generation	LN2 Automatic Cooling
Oxidation of Extruded Products	Airflow Shutoff Using Nitrogen for Extruded Sides
Mold Replacement Cycle	Mold Life Extended

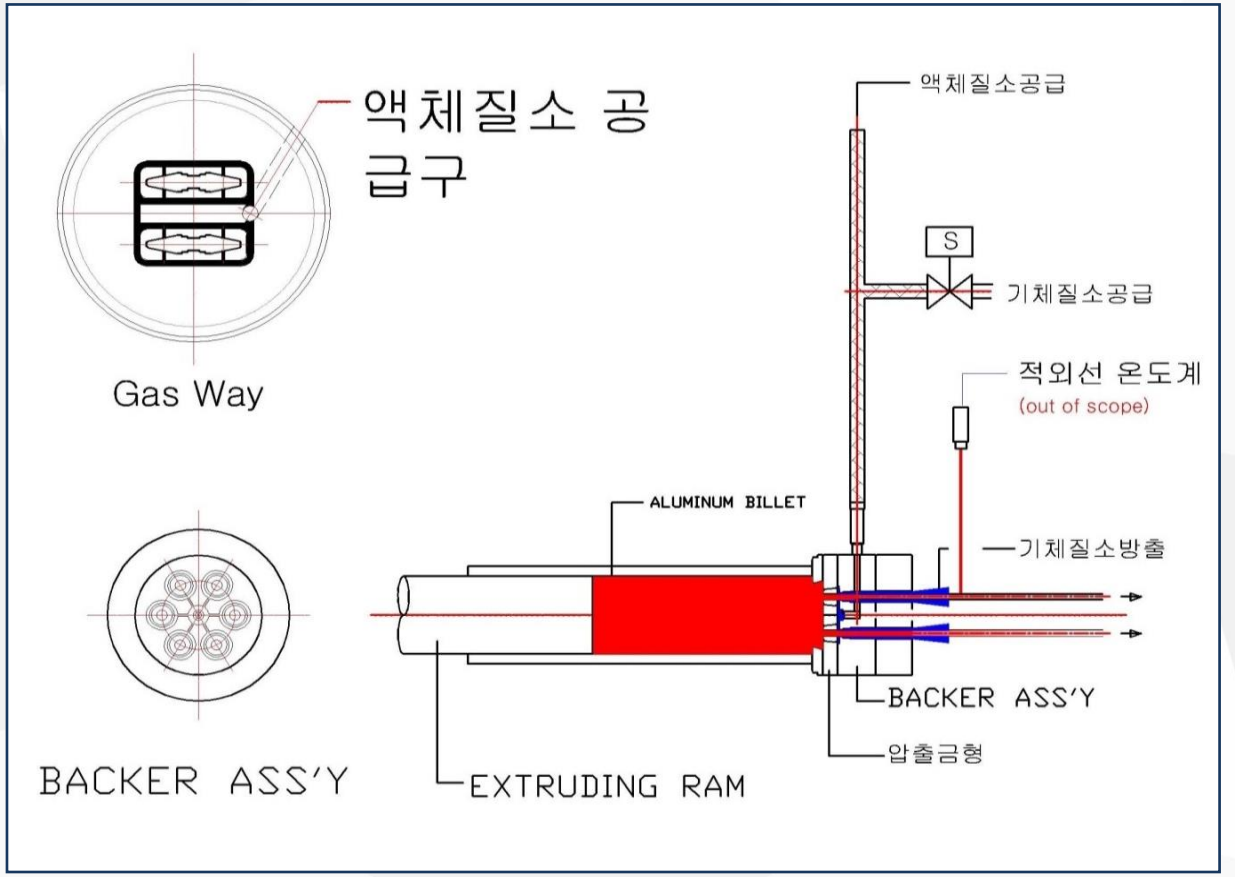


03. Extrusion Mold Structure Layout

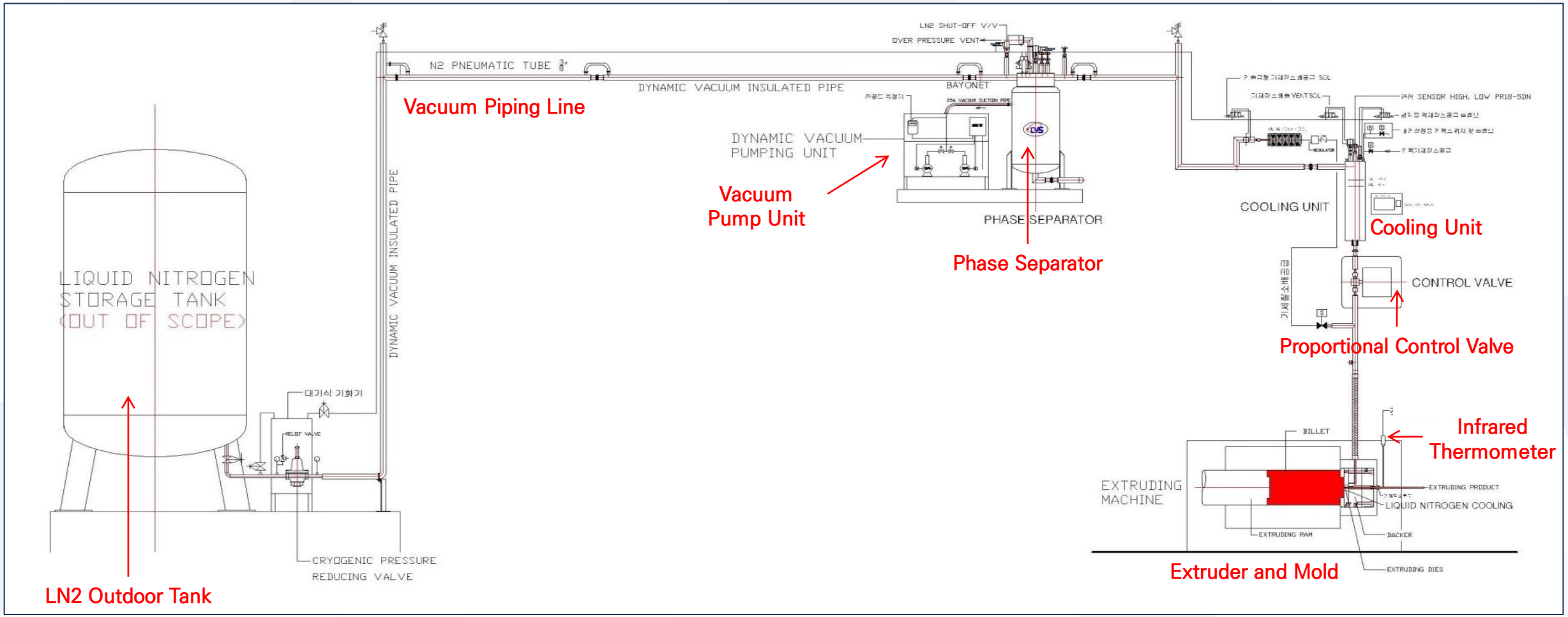


04. Cooling Sequence

1. Assemble the preheated extrusion mold and mount it onto the extruder.
2. Assemble the vacuum flexible hose that supplies liquid nitrogen to the mold backer.
3. Mount the billet that is heated to temperature of extrusion onto the extruder container.
4. Once the ram advances and extrusion starts, LN2 is supplied through the flexible hose to prevent surface oxidation of the product.



05. Aluminum Extrusion Mold LN2 Cooling System Layout



06. Extrusion Mold LN2 Cooling Effect

- Prevention of the mold bearing surface from overheating during extrusion
- Precise extrusion temperature control to suppress generation of defects.
- Improved productivity due to increased extrusion speed
  (Improvement of about 75% to 300% for different products)
- Improved product surface quality through overheating prevention and airflow shutoff
- Extended mold replacement cycle by 100% or more
- Improved extruder operation rate

07. Extrusion Speed Change After Use of LN2 Cooling System (Before vs. After)

NO	DIES	형 상	품 명	재 질	선속(냉각전)	선속(냉각후)	증가율	비 고
1			환봉	6082	2.2mm/sec	5.0mm/sec	227%	압출속도 2.2배증가 및 픽업 발생 없음
2			환봉	6110	1.9mm/sec	5.5mm/sec	289%	압출속도 2.8배증가 및 픽업 발생 없음
3			가구용	6061	4.0mm/sec	8.8mm/sec	220%	압출속도 2.2배증가 및 표면 조도 개선
4			Roof Rack	6063	6.5mm/sec	13mm/sec	200%	압출속도 2배증가 및 표면 조도 개선
5			PFC Tube	3000	4.0mm/sec	7.0mm/sec	175%	압출속도 1.75배증가 및 표면 조도 개선
6			Rubber Bush	6082	3.3mm/sec	8.3mm/sec	250%	압출속도2.5배증가 및 픽업 발생 없음
7			Engine Parts	6082	2.3mm/sec	5.5mm/sec	239%	압출속도 2.4배증가 및 픽업 발생 없음

Features

1. The above extrusion ram speed can be increased by adjusting the heating method of the billet, heating temperature, and extrusion temperature setting.
2. If the frictional heat generated from the friction surface of the extrusion mold is cooled with LN2 at −196℃, the extrusion temperature can be precisely adjusted; the extrusion speed can be increased; and the released gaseous nitrogen can improve the defects on the extruded product surface.
3. Gaseous nitrogen used by domestic extruders are used to improve surface roughness.
4. The above extrusion speed may differ depending on each company's billet heating method and extrusion mold.

08. Extrusion Mold Cooling System Composition

▲ CVS Phase Separator

▲ Double Cooling Unit

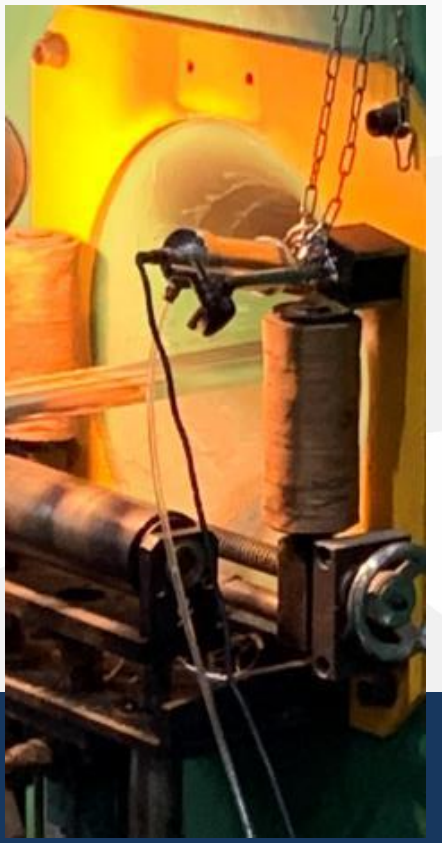
▲ Vacuum Pump

▲ Outdoor LN2 storage tank and thermal insulation piping line

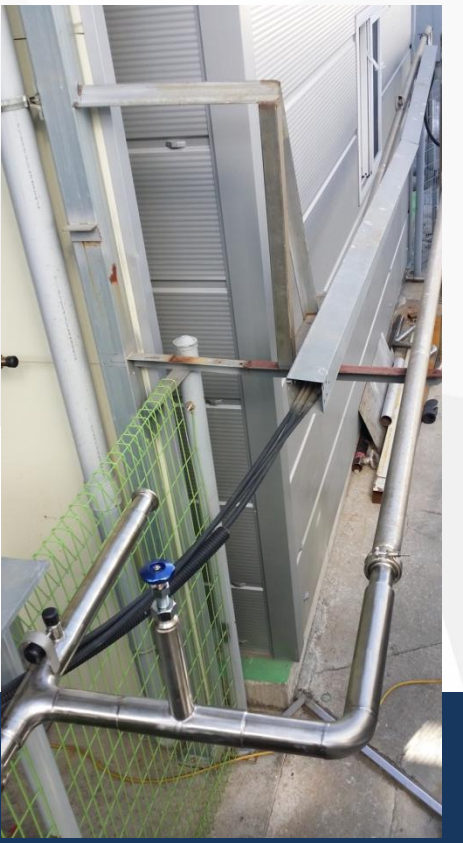
08. Extrusion Mold Cooling System Composition

▲ LN2 flow control valve

▲ Control Panel



▲ Infrared Thermometer



▲ Vacuum Pipe

08. Extrusion Mold Cooling System Composition
Phase Separator

Phase Separator

Two storage spaces are formed in the vacuum/insulated pressure vertical container.

The phase separator can separate the gaseous and liquid form nitrogen, when LN2 is being supplied via vacuum pipes, by externally discharging the gaseous nitrogen generated by the cool down effect while storing the pure LN2 left over from the gas-liquid separation process in the lower tank.

Upper Section : Installation of various units including supply valve/ outgassing vent / pressure sensor / relief V/V / level sensor / sol valve for pressure maintenance / pressure transmitter

A shutoff valve is installed between the upper section of the phase separator and the lower section of the LN2 storage tank.

The phase separator controls liquid nitrogen levels as well as the internal pressure and vents gaseous nitrogen through the Sol Valve when liquid nitrogen vaporizes, increasing the internal pressure to its preset conditions.

When the inner pressure is below its set conditions, gaseous nitrogen is injected from the outside in order to maintain those conditions and to supply LN2 at a constant pressure to the cooling unit.

When the internal pressure rises above the preset levels under unavoidable circumstances, the relief valve opens and releases externally.

08. Extrusion Mold Cooling System Composition
Double Cooling Unit

Double Cooling Unit

The extrusion mold cooling system is composed of the following functions: phase separation, LN2 storage, internal pressure maintenance, gas release, and LN2 level maintenance.
When the level detector senses a ‘low level,’ the upper liquid nitrogen supply valve and gas release valve open to receive liquid nitrogen from the phase separator storage tank in order to raise the levels to a ‘high level.' When the level reaches this ‘high level,’ the supply valve closes automatically.

The system consists of an inner tank and an outer tank in which the LN2 supply valves, gas release valves, internal pressure maintenance, internal pressure release valves, relief valves, pressure detectors, and level sensors are all installed within the upper section.
In the internal tank, the upper section has the function of phase separation while the lower section has the function of LN2 storage.

The high vacuum LN2 storage system automatically operates off PLC control. When the mold temperature rises, it supplies liquid nitrogen to the mold bearing surface via a LN2 flow control valve in order to cool frictional heat.

● How to Operate Double Cooling Unit

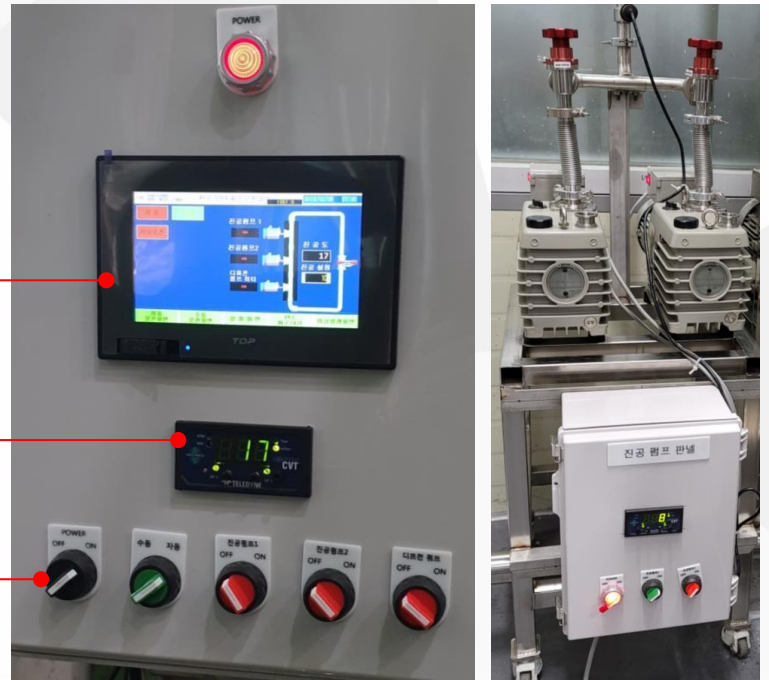
1. The left unit supplies LN2 to the mold for cooling.
2. The right unit receives and stores LN2 stored in the phase separator.
3. LN2 is supplied through the left and right units, alternately.

08. Extrusion Mold Cooling System Composition
Vacuum Pump

Dynamic Vacuum Pumping Unit

Dynamic Pumping Technique: A practice where a vacuum pump installed within the vacuum pipe and the container operates the vacuum pump, when the vacuum level of the equipment drops, in order to maintain optimum vacuum levels.

2 ea of vacuum pumps (1 Run. 1 Stand-by)
Vacuum measurement and 1 ea of controller
Vacuum Valve
Vacuum Sensor
Control Box



08. Extrusion Mold Cooling System Composition
Flow Control Valve

Flow Control Valve

An infrared pyrometer measures the temperature of the extruded product that has passed through the extrusion mold. The flow control valve controls the supply of LN2 stored in the cooling system via PID control of the temperature controller and cools down the extrusion mold with liquid nitrogen.

The bypass valve opens in order to operate a prompt anti-overheating system.

08. Extrusion Mold Cooling System Composition
Vacuum Pipe

Vacuum Pipe

The vacuum pipe is an insulated structure with a liquid nitrogen transportation vessel pipe inside made of multiple layers of thin aluminum plates and an ultra-low temperature insulation material made of fiberglass.

A thin aluminum plate blocks radiant heat while the fiberglass blocks conduction heat.
The vacuum pipe is assembled with vacuum layers formed between the insulated inner tube and outer tube, with a bayonet installed at both ends for easy assembly and disassembly.

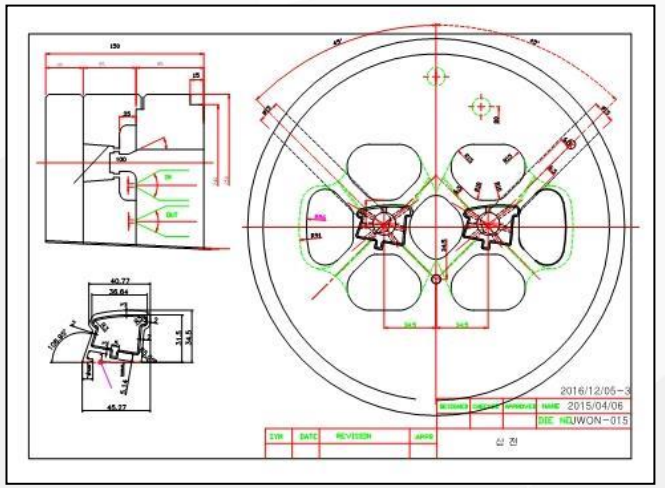
All joints are argon-welded and inspected with a Helium Leak Detector.
CVS' vacuum pipe for LN2 supply, which removes impure gases and moisture with a vacuum pump while maintaining a high vacuum level of 10-3 torr, minimizes liquid nitrogen loss caused by vaporization.

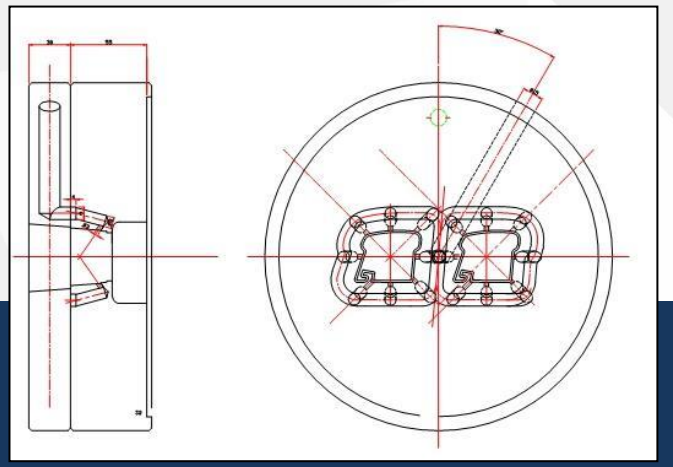
08. Extrusion Mold Cooling System Composition
Infrared Pyrometer (Temp. Pyrometer)

Infrared Pyrometer (Temp. Pyrometer)

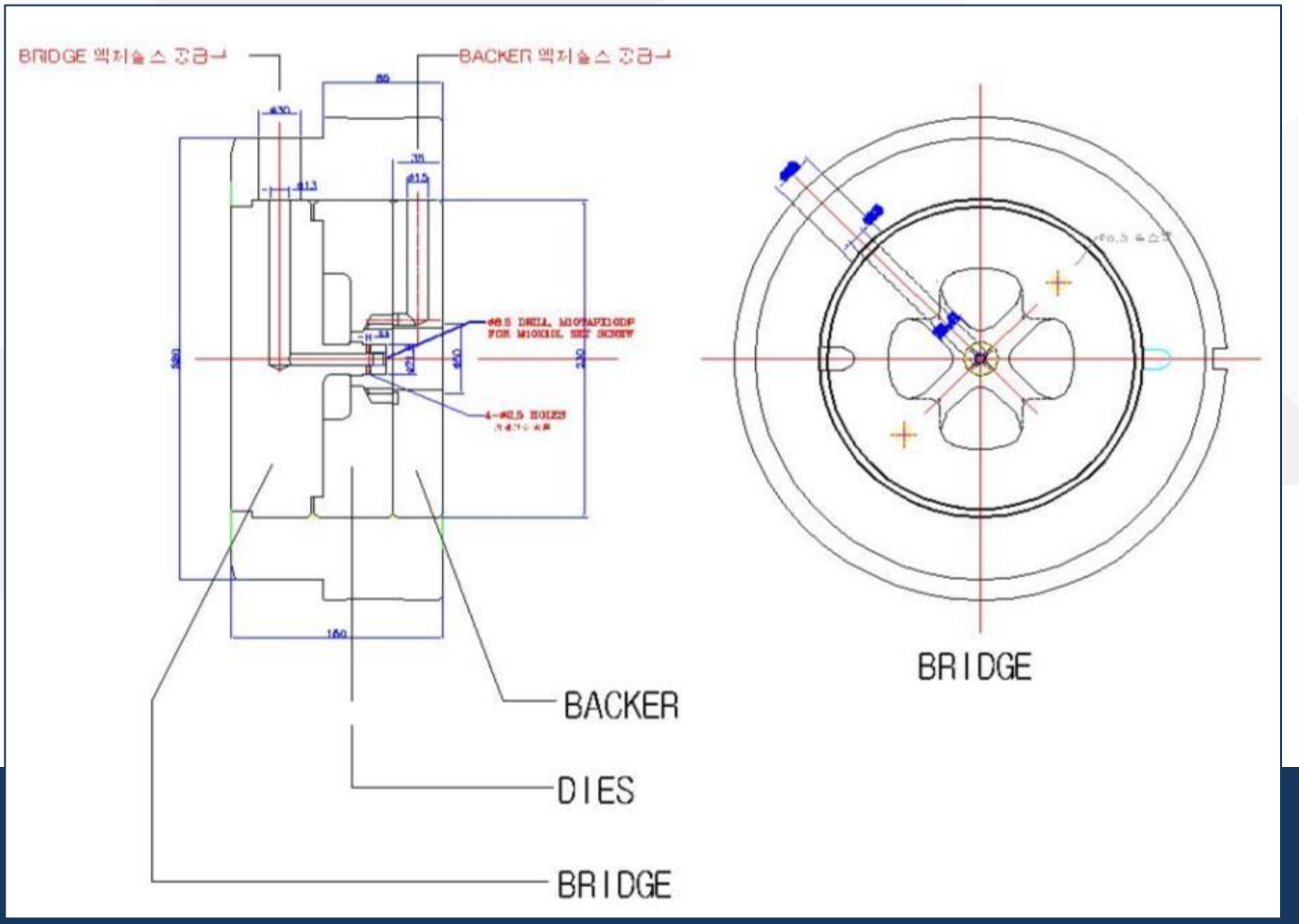
The infrared pyrometer measures in real-time the temperature of an extruded product that is closest to the extrusion mold so as to help the LN2 flow control valve conduct its opening and closing functions.

09. LN2 Cooling Channel Blueprint





▲ Extrusion Mold Layout for Roof Rack



▲ Extrusion Mold Layout for Rubber Bush

CVS PRODUCT

CVS Product

LN2 Doser

The LN2 doser, developed with our very own technology for the first time in Korea and installed in a number of automated lines, is our flagship product and has been operating in domestic canned beverage production lines for over 10 years.
The self-developed equipment stacked with CVS' technology has been recognized by many companies. It is also patented equipment for CVS' proprietary technology.

The LN2 doser produced by CVS has been supplied to domestic companies such as Coca-Cola Korea, Dongwon F&B, OKF, Wooil Beverage, and Naturecell, being recognized for its excellent performance.

CVS Product

Mini LN2 Doser (M-2100)

The existing LN2 dosers are mostly installed in beverage mass production lines. They are large in size and designed exclusively for mass production processes.

The mini LN2 doser is a piece of equipment that has minimized the volume and functions of the existing LN2 dosers.

It is a newly developed doser that has been reduced in size, aiding small businesses, such as retail stores, home brewed coffee shops, and homemade juice sellers, with easy liquid nitrogen injections, rather than mass production automated factories.

CVS' LN2 doser, with its reduction in size and price when compared to the LN2 dosers designed for mass production, allow for easy access of liquid nitrogen dosers to individual cafe owners and can/PET beverage producers.

CVS Product

Application LN2 Doser

The medium-sized LN2 doser supplied to HITEJINRO and its corporate research institutes is used for the purpose of conducting corporate research as well as for experiments and tests.

Additionally, CVS are leaping forward drastically to develop and manufacture new cryogenic application equipment in collaboration with companies.

Thank You !

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