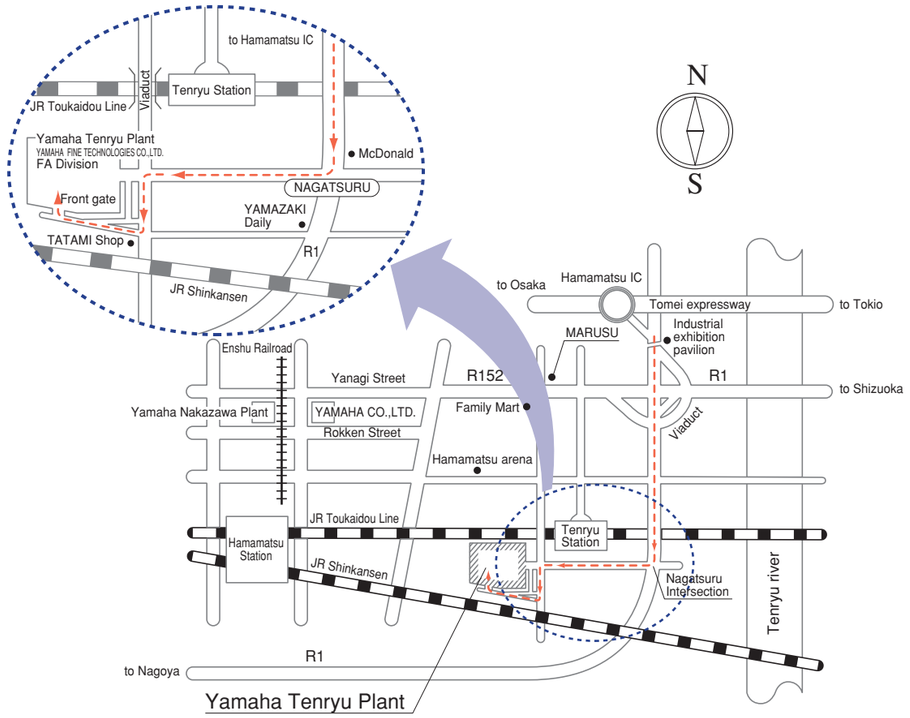

【Traffic access】 Get off the Shinkansen (bullet train) at Hamamatsu Station and get a taxi.
Tell driver to take you inside the “Yamaha Tenryu Plant”. (About a 10 minute ride).

Contact for product inquiries ---------- **FA sales division TEL+81-53-467-3601**

Contact for inquiries about maintenance, inspections, or service. ---------- **User Service Center TEL+81-53-467-3606**

YAMAHA

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283 Aoyo-cho, Minami-ku, Hamamatsu, Japan 435-8568
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URL : http://www.yamaha.co.jp/finetech/

JQA-1614

YAMAHA

Helium Leak Tester

He Leak Tester System

The Yamaha Helium Leak Tester is an innovative system for pass-fail testing that compares leaked gas quantities to a preset figure. In a simple procedure, the work piece is set into the vacuum chamber, helium gas is then injected into the work piece at a specified pressure, and the leak detector then measures leaked helium gas in chamber from the work piece. The Yamaha system can also detect leaks using the sniffer technique.

HELIUM LEAK TESTER FEATURES

1 Accurately detects even faint leaks

Unique system configuration developed by Yamaha detects even ultra-small leaks at an accuracy of 100 to 1,000 times higher than conventional water bubble method and pressure decay method. This ensures high-reliability testing!

2 Directly production line and short test tact time

The advanced technology of Yamaha enables laborsaving and full automation by directctly product line or conveying robot etc.

3 Fail safe system eliminates errors

Yamaha leak system reduce the load of worker, as such sorting of good or defect parts, marking, processing checks, and interlocks, and is a safety design that prevents errors

4 Low running costs

Yamaha leak system delivers both reliability and low maintenance costs, since recovers over 80 percent of helium used as the trace gas and automatically monitors the concentration and pressure.

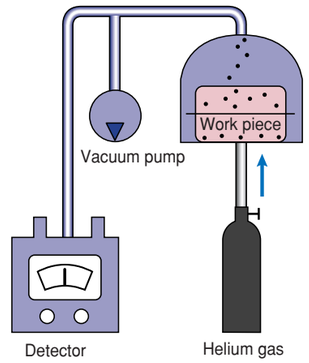
5 Easy maintenance and handling

Sophisticated system provides total system control, making handling and servicing easy. In case of operator errors or machine troubles, an auxiliary console with self-diagnostic functions displays messages for speedily and accurately restoring machine operation.

TRACE GAS METHOD

HELIUM LEAK TESTER

■Vacuum chamber Method



Advantages

- Reliably identifies overall leakage
- Fast leakage measurements
- No man-made errors
- Process is easy to automate
- Helium needs no purification to remove contaminants

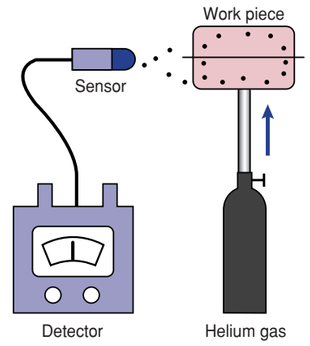
Disadvantages

- Equipment is large-scale
  [**We offer separate, simplified models (detection performance subject to certain conditions)**]
- Cannot identify separate individual leak positions

Measurement Range

- 10-8［Pa・m3/sec］(paschal cubic meters per second)or more in actual operation

■Sniffer Method



Advantages

- Directly finds the leak points
- Installation is simple (needs little space)
- Inexpensive equipment costs

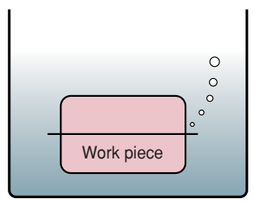
Disadvantages

- Cannot measure leak unless probe directly contacts the leakage point
- Operating the probe requires considerable experience
- Cannot measure leakage quantity for entire work piece

Measurement Range

- 10-6［Pa・m3/sec］(pinpoint) in actual operation

Water Bubble Leak Method



Advantages

- Equipment is simple and so is operation
- Leakage can be directly checked
- Low running costs

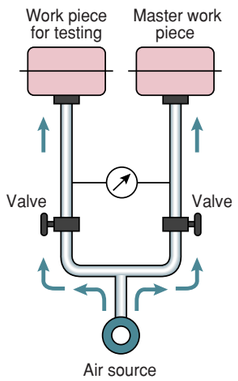
Disadvantages

- Requires experience (problems are easily overlooked)
- Immersed test item has to be cleaned/dried later on
- Requires controlling the water transparency, etc.
- Cannot quantitatively monitor the leak rate
- Poor work environment
- Difficult to automate the process
- Man-made errors are possible

Measurement Range

- 10-4 ［Pa・m3/sec］ during actual operation
- The lower the leak rate, the more time that is needed

Pressure Decay Method



Advantages

- Equipment is comparatively simple
- Can measure leakage in entire work piece being tested Disadvantages

Disadvantages

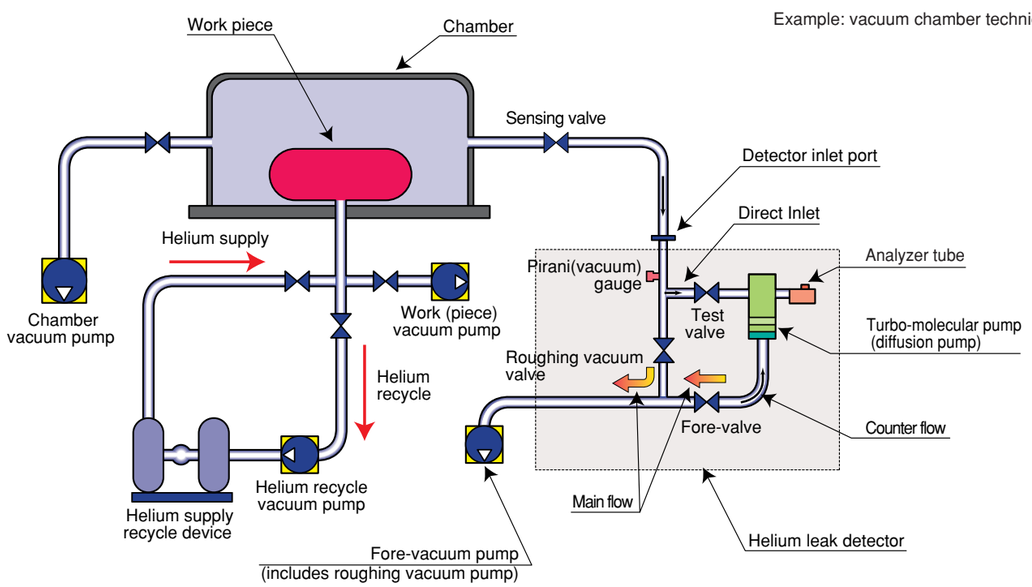
- Work piece temperature exerts a large effect
- Ambient temperature exerts a large effect
- Poor sensitivity
- Cannot identify the leakage points

Measurement Range

- 10-4 ［Pa・m3/sec］ during actual operation
- The lower the leak rate, the more time that is needed

Note: Detectable leak rate is the usually detected leakage rate.

HELIUM LEAK TESTER (CHAMBER TYPE) SYSTEM DIAGRAM



FEATURES

1. Overall Evaluation

Yamaha provides a total system to the customer. Yamaha develops original helium detectors, and does all the process from design of control circuits to assembly and adjustment of helium leak tester in the company. Also, Yamaha can select optimal devices for a leak tester and has various systems for test, Yamaha's leak tester is high relied. So there are many repeaters using Yamaha's leak tester, and Yamaha has the No.1 share in the leak tester market for aluminum wheels and air conditioner related products in Japan.

2. Numerous Technical Advantages

(1) Makes helium leak tests in a low vacuum chamber pressure (100 to 500 Pa)

BIG ADVANTAGES FROM MAKING LEAK TESTS IN A LOW VACUUM

① Time for vacuuming in the chamber stable and not affected much by the environment (humidity, moisture, etc.).
② Maintenance of chamber to maitain vacuum is easy.
③ Recovers quickly from large helium leakage.
④ Time for vacuuming is short since unit needs no rouging vacuum or main vacuum, space-saving system design allows flexibility during installation.
⑤ Allows use of high durability vacuum pumps
⑥ Lowers the initial cost of vacuum pump
⑦ Few or minimal restrictions on system installation site, such as on space or floor weight-bearing strength.

Reason why our leak tester can work in a low vacuum

① Yamaha has the original technique that reduces the residual helium in the air of the chamber.

② Unit utilizes a helium leak detector capable of making leak tests under a low vacuum.

(2) Selecting The Best Leak Tester Components For Your Equipment

High Performance Leak Detector

① Analyzer tube with 180 degree magnetic deflector and special sensor provide high resolution
② Uses high-efficiency filaments
③ Inlet section is tough against vacuum breakdowns

Chamber Vacuum Pump

① Strong to withstand repeated vacuum and pressure recycling
② Air-cooled type
③ Needs no mist separator for oil exhaust emissions

(3) High Reliability leak standard unit (master capillary)

①Utilizes officially certified measurement unit and leak standard unit certified by independent testing organization.
②Leak standard unit is made from stainless steels instead of glasses or resins,so it is not breakage of cracks and fractures and is excellent in durability or reliability.
③Fluctuations in the helium leakage quantity are extremely small
④It is possible to get tranceabilities for ISO

(4) Extremely simple equipment handling

①Sophisticated system completely protects the precision equipment. Maintenance and handling is easy.
②Self-diagnostic auxiliary console displays messages for speedily and accurately restoring machine operation, in case of operator errors or machine troubles.
③Machine returns to origin point by pushing a button, so it is easy to operate the system after maintenance.

WHY HELIUM IS USED AS THE TRACE GAS

The Yamaha leak tester utilizes the trace gas technique. Helium is mainly used as the trace gas. Helium is used as the trace gas because of the many benefits it provides.

1. Helium is a safe and harmless gas that does not threaten the human body or the environment.
2. Helium is non-combustible and therefore safe.
3. Helium molecules are small and light and so can easily escape through the smallest holes or openings.
4. Helium is only present in tiny quantities in the normal atmosphere and so can easily be identified as different from leakage test helium.
5. Helium is difficult to liquefy in most environments and so will never clog the leakage holes.
6. Helium is a chemically inert gas and so will not cause metal to rust.

Why is Helium?

[He] [Atomic number:2] [Atomic weight:4.003] It is a colorless, odorless, tasteless, non-toxic, inert monatomic gas that heads the noble gas group in the periodic table. Helium is contained 5ppm by volume in the atmosphere. It is the second lightest element and is the second most abundant in the observable universe. Helium is chemically stable and does not form compounds with other elements. Its boiling and melting points are the lowest among the elements and it exists only as a gas except in extreme conditions. Helium uses as a pressurizing and purge gas, and a protective atmosphere for arc welding and processes (such as growing crystals to make silicon wafers), account for half of its use. Economically minor uses, such as lifting gas in balloons and airships are popularly known.
melting point：-272.2℃(26atm), boiling point：268.9℃, critical temperature：-268℃, critical pressure：2.25atm, density：0.179g/dm^3(0℃,1atm), liquid density：0.125g/cm^3(-269℃)

Excerpt from wikipedia

LEAK TEST PRODUCT MARKETS

Leakage rate	10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4} Pam^3 / sec or over	
Methods of Leak Test			CHAMBER METHOD		WATER BUBBLE LEAK METHOD or PRESSURE DECAY METHOD	SNIFFER METHOD
Automotive		Fuel strainers	Car air conditioner piping Car air conditioner heat exchangers Car compressors Condensers Evaporators Liquid tanks Air tanks ＊ EGR cooler pipes Common rails Delivery pipes Injectors ＊ Airbags	Inlet tubes ＊ Inlet blowers Fuel tanks Battery case ＊ Power steering Shock absorbers	Aluminum wheels Steel wheels Radiators ＊ Oil tanks ＊ Oil pumps ＊ Inlet manifolds ＊ Torque converters Engine assemblies Differential gear case ＊ Chassis pipe connectors ＊ Transmission pipe connectors ＊ Engine pipe connectors ＊ Boat tilt parts	＊ Transmission case peripheral parts Brake tubes Body cylinder cases Brake cylinders ＊ Oil pans ＊ Mufflers Exhaust manifolds
Home electronics			Air conditioners-coolers Package air conditioners Refrigerators			
Food Industres			Showcase heat exchangers Freezers Vending machines		Beer casks	
Cooking equipment-Household appliances	Fire extinguishers			Door closers Thermos		Gas cooking equipment
Medical Products					Chemical closets Catheters Pacemakers Dialysis machines	
Drums & Canisters					Spray cans	Drum 18 liter cans Stove fuel tanks Oil cans

EQUIPMENT USING DIFFERENTIAL WATER BUBBLE LEAK METHOD or PRESSURE DECAY METHOD

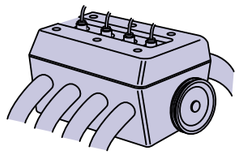
	Agricultural Machinery	Motorcycle Parts	Construction Equipment	Plant Industrial Equipment	Disaster Prevention Equipment	Hydraulic-Pneumatic Parts	Water/Sewer Line Equipment	Construction Equipment	Oil-Kerosene Equipment	Gas Equipment	Home Electrical Appliances	Industrial Electrical Equipment
WATER BUBBLE LEAK METHOD or PRESSURE DECAY METHOD	・Fuel tanks ・Transmissions ・Engines	・Fuel tanks ・Transmissions ・Carburetors ・Engines	・Engine parts ・Hydraulic piping ・Rotors	・Pipes ・Valves ・Couplings	・Sprinklers ・Fire alarms	・Hydraulic & pneumatic solenoid valves ・Air cylinders ・Couplers ・Check valves	・Water faucet hardware ・Water line valves	・Unit baths ・Wall materials ・Sanitary ceramic ware ・Sinks ・Door checks ・Floor materials	・Kerosene heaters ・Cartridges ・Oil pumps	・Gas meters ・Cutoff valves ・Gas hot-water heater equipment ・Gas cooking appliances ・Gas hoses ・Gas valves (cocks/faucets)	・Batteries of all types ・Waterproof shavers ・Waterproof vacuums ・Waterproof radios ・Laundry machine parts ・Irons	・Hermetic seal motors ・Speed reducers ・Relay switches

	Communication Equipment	Office Equipment	Computers	Health Care	Electronic Components	Medical Equipment	Precision Equipment	Pharmaceuticals	Rubber products	Toiletries	Cosmetic Equipment	Foodstuff Pack Wrapping
WATER BUBBLE LEAK METHOD or PRESSURE DECAY METHOD	・Satellite transceiver devices ・Water-proof communication equipment ・Communication connectors	・Toner bottles/cans for copiers ・Correcting ink ・Printer cartridges	・Hard disk ・HDD connectors	・Ionized water apparatus ・Water purifiers ・Electronic thermometers ・Electric toothbrushes	・CCD imagers ・LSI ・Crystal oscillators (pumping technique)	・emopumps ・ransfusion packs ・Hypodermics or syringes	・Water-proof cameras ・Wristwatches (pumping technique)	・Pillow packs ・PTP ・Powder packages Ointment tubes	・Nipples ・Hoses ・Film products	・Moist towels ・Pack products	・Shampoo pumps ・Nozzles	・Processed meats ・Noodles ・Sweets

PRODUCTS FOR LEAK TESTS

AUTOMOTIVE FIELD

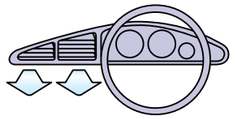
ENGINE



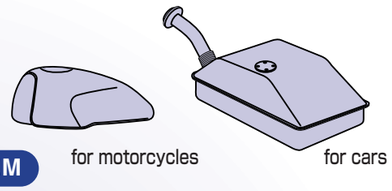
- Radiators
- Water pumps
- Cylinder heads
- Cylinder blocks
- Oil pans
- Engine assemblies
- Delivery pipes
- Injectors
- Common rails
- Oil pumps

AIR CONDITIONERS

- Car compressors
- Condensers
- Evaporators
- Liquid tanks
- Car air conditioner pipes



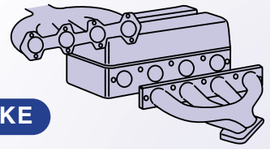
FUEL SYSTEM



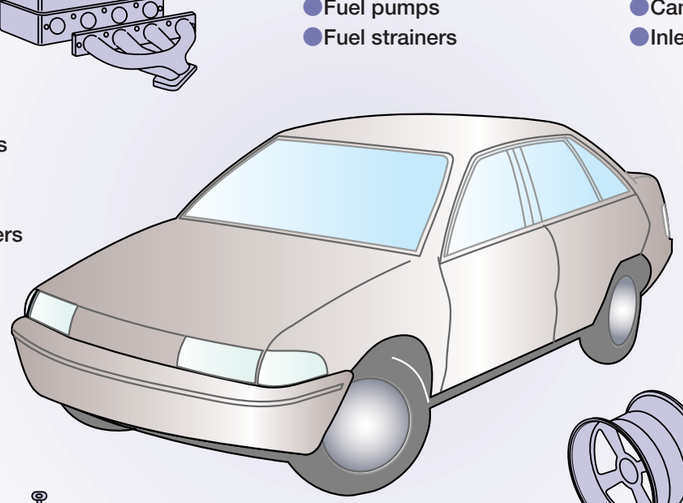
for motorcycles for cars

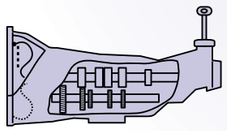
- Fuel tank assemblies
- Fuel pumps
- Fuel strainers
- Fuel pipes
- Canisters
- Inlet tubes

AIR INTAKE



- Intake manifolds
- Exhaust manifolds
- Intercoolers
- Turbochargers
- Catalytic converters
- Mufflers

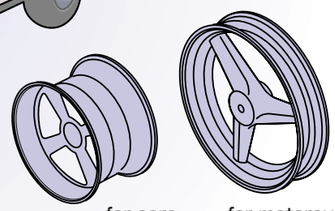




TRANSMISSIONS

- Torque converters
- Transmission cases
- Cylinder second brakes
- Oil pump housings

WHEELS



for cars for motorcycles

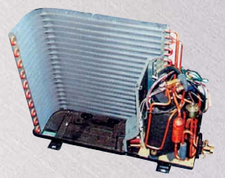
- Aluminum wheels
- Aluminum temporary wheels
- Steel wheels

OTHERS

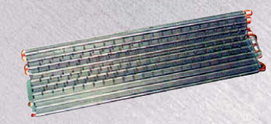
- Power steering
- Steering pumps
- Shock absorbers
- Air suspensions
- Brake master cylinders
- Brake boosters
- Air tanks
- Inflators

AIR CONDITIONING-REFRIGERATION FIELD

- Air conditioner parts
- Evaporators
- Refrigerator coils
- Compressors
- Valve types
- Outdoor air conditioner assemblies



Outdoor air conditioner assemblies



Air conditioner indoor unit heat exchangers

Compressors for home appliances

OTHERS

HOME ELECTRICS

- Refrigerators
- Batteries of all types
- Waterproof Shavers
- Waterproof vacuums
- Waterproof radios
- Laundry machine parts
- Irons

FOOD INDUSTRIES

- Showcase heat exchangers
- Freezers
- Vending machines
- Beer casks

GAS EQUIPMENT

- Gas meters
- Shutoff valves
- Gas hot-water heaters
- Gas cooking appliances
- Gas hoses
- Gas valves

MEDICAL EQUIPMENT

- Chemical closets
- Catheters
- Pacemakers
- Dialysis machines
- Hemopumps
- Transfusion packs
- Hypodermics

PRECISION EQUIPMENT

- Water-proof cameras
- Waterproof clocks

DRUMS & CANISTERS

- Drum cans
- 18 liter cans
- Stove fuel tanks
- Oil cans
- Spray cans

HYDRAULIC-PNEUMATIC PARTS

- Hydraulic solenoid valves
- Pneumatic solenoid valves
- Air cylinders
- Couplers
- Check valves

WATER-SEWER LINE EQUIPMENT

- Water faucet hardware
- Water (line) valves

CONSTRUCTION EQUIPMENT

- Unit baths
- Wall materials
- Sanitary ceramic ware
- Sinks
- Door checks
- Floor materials

OIL EQUIPMENT

- Kerosene stoves or heaters
- Cartridges
- Oil pumps

COMMUNICATION EQUIPMENT

- Satellite transceiver devices
- Water-proof communication equipment
- Communication connectors

YAMAHA He LEAK TESTER SYSTEMS

AW20•30•60 He Leak Tester for Aluminum Wheels

1. Accurately detects minute leaks
2. Directly production line and short test tact time
3. Failsafe system eliminates errors
4. Low running costs
5. Service, handling, and maintenance are extremely simple

■ Dedicated leak tester machines for car & motorcycle aluminum wheels

A pressurized helium gas mixture is injected into the chamber at a specified pressure, and the detector uses the mass spectrometry to measure leakage of trace gas into the aluminum wheel. The part is then judged a pass-fail based on the size of the measured leak compared with a leak threshold value.

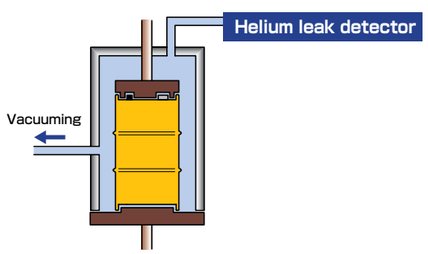
■ Automatically detects leaks - No need to select (12 to 20 inch) wheel sizes

He leak tester automatically detects and tests for leaks in 12 to 20 inch wheel sizes to match whatever wheel is being manufactured on the factory line. This feature allows greater freedom in production planning.

■ Automatically checks equipment status

Master checks are made at preset times during continuous operation to constantly ensure if operation is normal, and that testing is accurate.

DK-1 He Leak Tester for Drums



■ Inspection of total product maintains reliability

Leak tests of large drum products up to now were made by methods such as pressure-drops, water bubble method, or coating soapy water onto the machined sections of the product, but accurately finding leaks was still a tough task. The DK-1 leak tester drastically boosts product reliability by using helium leak inspections to accurately and automatically find minute leaks in welded section and seam sections on the machined work piece as well as material defects.

■ Deformation preventive for thin-walled containers

Equipment utilizes a warp-preventer mechanism that blocks product warping that occurs due to pressure differentials during leak inspections. This does not require a special jig and so vastly improves the device cost effectiveness.

■ High manufacturing efficiency by high-speed detection & high-speed conveying

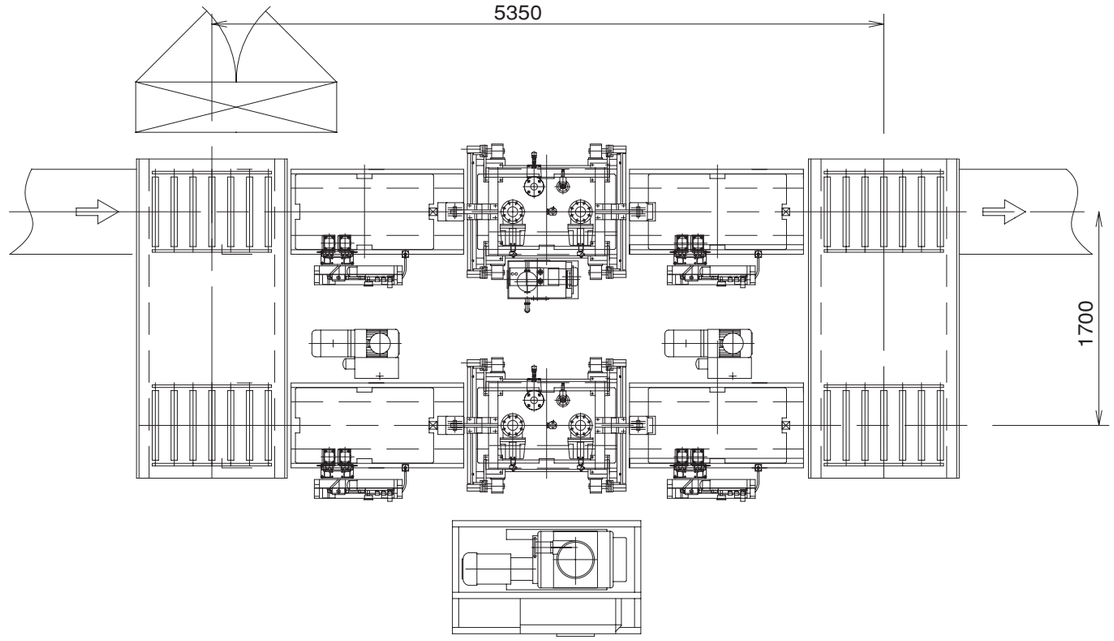
The DK-1 leak detection speed matches the drum production speed, and peripheral devices (conveyors) are integrated into the overall inspection station system. This makes it easy to configure a line to match the product and drastically boosts productivity!

FT-1 He Leak Tester for Fuel Tanks

- Accurately detects even minute leaks
- Differential pressure control function prevent work piece from warping inside vacuum chamber
- Diverse fail-safe functions safeguard the detection circuits when measuring large work piece leakage

CUSTOM-MADE SYSTEMS

We design and fabricate dedicated systems to match the customer's own unique specifications.



Note: This drawing shows one example of a leak tester station and conveyors for the leak tester system.