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**Non-destructive testing—Selection
of leak testing method**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japanese Society for Non-Destructive Inspection (JSNDI)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS Z 2330**:1992 is replaced with this Standard.

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Non-destructive testing—Selection of leak testing method

1 Scope

This Japanese Industrial Standard specifies the classification of leak testing methods commonly used and the guideline for the selection method of adoption thereof. However, this Standard is not intended for the enforcement of practical selection methods.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS Z 2300 *Terms and definitions of nondestructive testing*

JIS Z 2329 *Methods for bubble leak testing*

JIS Z 2331 *Method for helium leak testing*

JIS Z 2332 *Test method for leaks using the pressure change measurement*

JIS Z 2333 *Test method for leaks using ammonia gas*

JIS Z 2343-1 *Non-destructive testing—Penetrant testing—Part 1: General principles—Method for liquid penetrant testing and classification of the penetrant indication*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS Z 2300** apply.

4 Classification of leak testing methods

The leak testing methods are classified into the method using liquid, the method using gas such as air and the method using specific searching gas. In addition, they are classified into practical testing methods according to the leaking substance, and the principle and means (colouring, bubble, pressure gauge, mass spectrometer and semiconductor sensor, etc.) of leakage detection. On the other hand, there are many application methods depending on the pressurization and depressurization methods to induce the leakage, the sample method of the detection gas and the like.

4.1 Leak testing using liquid

There are following methods to detect the leakage using liquid. However, the method of direct visual observation of leaked liquid in hydraulic test is excluded from the leak testing methods specified in this Standard.

4.1.1 Leak testing by adding fluorescent dye

Detecting method where the test body is filled with liquid to which the fluorescent dye is added and observed in dark place by irradiating ultraviolet rays.

4.1.2 Leak testing using developer

Detecting method where the developer is applied to the surface of test body filled with liquid, the liquid is sucked by utilizing capillarity from the leakage location and the magnified indication with good discrimination is formed to detect the leakage. The developer includes that specified in **JIS Z 2343-1** or that develops colours or generates fluorescent colour on contact with the liquid. In either case, the developer suitable for the target liquid shall be used.

4.1.3 Leak testing using penetrant

Detecting method utilizing the penetrant and the developer specified in **JIS Z 2343-1**. The penetrant is applied to one side of test body and it is sucked by the developer applied to the other side, and the indication of red on white background or fluorescence in dark place is formed to detect the leakage.

4.2 Leak testing using gas such as air

There are following methods to detect the leakage utilizing the bubble phenomenon, pressure change of test body inside, ultrasonic wave generating from leaking point, etc.

4.2.1 Leak testing by immersion

Detecting method where the test body pressurized with gas is immersed in the liquid, and the leakage is detected by bubble from the test body inside. Generally, water is used for the liquid and in that case it is called the water immersion test. When water has negative influence to the test body, there are cases of using organic solvents such as fluorocarbons.

4.2.2 Leak testing using bubble

Detecting method where a liquid containing surfactant, etc. (foaming liquid) is applied to the surface of test body, and the leakage gas is detected by bubble phenomenon. In the pressurization method, the test body inside is pressurized with air, etc., the foaming liquid is applied to the test body outside, and the bubble coming out from the test body inside are detected. In the vacuum method, the test body inside is left as it is, the test body outside is depressurized by using a vacuum case, etc., the foaming liquid is applied to the part, and the gas sucked out is observed as the bubble. The testing method is as specified in **JIS Z 2329**.

4.2.3 Leak testing using change in pressure

Detecting method where the test body inside is pressurized or depressurized, and the change in pressure by leakage is measured. There are methods such that the change in pressure is directly measured with the pressure gauge and the differential pressure between the reference vessel and the test body is measured with the differential pressure gauge to detect the small leakage in short period. The testing method is as specified in **JIS Z 2332**.

4.2.4 Leak testing using flow rate measurement

Detecting method where the test body inside is connected with the pressurizing vessel and the leakage is measured so that the amount of gas flowed into to compensate the loss amount due to leakage is measured with the flow meter.

4.2.5 Leak testing using ultrasonic wave

Detecting method where the ultrasonic wave generated at the gas leakage from the leak position or the ultrasonic leakage from the ultrasonic wave transmitter placed on test body inside is detected with the ultrasonic wave detector. The ultrasonic wave is indicated by dB indication or the speaker sound.

4.3 Leak testing using search gas

Detecting method where a specific gas is used as the search gas, and the leakage thereof is detected by an analyzer (leak detector) having high sensitivity to that gas or by using reagents. The type of test, search gas, detector, inspection agent and application method are as follows.

4.3.1 Main types of testing

- a) **Helium leak testing** The method to detect the leakage with helium detector utilizing helium gas as the search gas. The testing method is as specified in **JIS Z 2331**.
- b) **Hydrogen leak testing** The method to detect the leakage with hydrogen detector utilizing hydrogen gas as the search gas.
- c) **Halogen leak testing** The method to detect the leakage with halogen detector utilizing halogen gas as the search gas.
- d) **Ammonia leak testing** The method to detect the leakage utilizing ammonia gas as the search gas such that the leakage is detected with the blue indication when the inspection agent whose colour changes from yellow to blue by chemical reaction if it touches ammonia is applied to the surface of test body. The testing method is as specified in **JIS Z 2333**.

4.3.2 Search gas

Helium gas, hydrogen gas, halogen gas, ammonia gas, etc. are used for the search gas in the leak testing. The outline of the search gas is as follows.

- a) **Helium gas** The concentration of helium gas in the atmosphere is 5×10^{-6} in volume fraction. It is inert and the molecular diameter thereof is smaller, therefore, it is excellent in detection of small leakage.
- b) **Hydrogen gas** The concentration of hydrogen gas in the atmosphere is about 5×10^{-7} in volume fraction. As there is the risk of explosion, from the point of view for safety, it shall be mixed with nitrogen gas, etc. and used at the non-flammable concentration in the leak testing.
- c) **Halogen gas** The gas containing halogen gas such as chlorine, fluorine is used. When released to the atmosphere, it often causes the depletion of ozone layer. Attention shall be sufficiently paid to the treatment thereof in consideration of the toxicity and the impact on global warming. Mainly, it is used for the leak testing of enclosed gas in the test body to which halogen gas is enclosed as the refrigerant.
- d) **Ammonium gas** As there is the risk of explosion at high concentration, it is generally mixed with nitrogen gas, etc. and used at the concentration of 1×10^{-1} to