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# GLOSSARY OF TERMS USED IN NON – DESTRUCTIVE TESTING

## PART 2 – MAGNETIC PARTICLE FLAW DETECTION

SRI LANKA STANDARDS INSTITUTION

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## PART 2 MAGNETIC PARTICLE FLAW DETECTION

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# SRI LANKA STANDARD
# GLOSSARY OF TERMS USED IN NON-DESTRUCTIVE TESTING
## PART 2 MAGNETIC PARTICLE FLAW DETECTION

**FOREWORD**

This standard was authorized for adoption and publication as a Sri Lanka Standard by the council of the Sri Lanka Standards Institution on 90-10-10, after the draft, finalized by the Drafting Committee on Non-destructive Testing, had been approved by the Mechanical Engineering Divisional Committee.

This glossary has been prepared to promote understanding of the subject with regard to the terms encountered in technical literature and reports on non-destructive testing in general and magnetic particle flaw detection in particular. This glossary does not include general technical terms which are defined in other standards except in those cases where such terms have a particular application in this field of non-destructive testing.

The terms defined in this glossary are arranged alphabetically, and where two or more terms have come into use with virtually the same meaning, the term to be preferred has been selected for definition.

This glossary is published in four parts as follows :

Part 1 Penetrant flaw detection
Part 2 Magnetic particle flaw detection
*Part 3 Radiological flaw detection
*Part 4 Ultrasonic flaw detection

The Sri Lanka Standards Institution gratefully acknowledges the use of relevant publications of the British Standards Institution and the American Society for Testing and Materials in the preparation of this standard.

## 1 SCOPE

This glossary defines technical terms widely used in magnetic particle flaw detection method of non-destructive testing.

* *Under preparation.*

## 2 GLOSSARY

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| adaptation to darkness | The adjustment of the eyes when one passes from a bright to a darkened place. |
| Adjacent cable technique | A technique of magnetization in which an insulated, current-carrying cable is laid, adjacent to the area to be tested. |
| Ampere/metre (A/m) | The field strength in air, at the centre of a single-turn circular coil having a diameter of 1 m, through which a current of 1 A is flowing.<br><br>*NOTE*<br>*This is the SI unit of field strength which has replaced the oersted (1 oersted = 79.58 A/m).* |
| aperture type coil | An alternating current-carrying coil constructed in such a way that components may be passed through it for the purpose of demagnetization. |
| ampere turns | The product of the number of turns of a coil and current in amperes flowing through the coil. |
| background | In magnetic particle examination, the appearance of the surface of the test part against which indications are viewed. It may be the natural surface or a contrast aid on the surface. |
| background paint | See 'contrast aid'. |
| black light | See 'UV-A'. |
| black light filter | See 'UV-A filter'. |

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| burning | In magnetic particle examination, local overheating of the test part at the electrical contact area arising from high resistance, or the production of an arc, or prolonged contact. |
| captive fluid indicator | A device comprising a quantity of magnetic ink sealed in a transparent container, the ink behaving in the same way on a magnetized component as free magnetic ink. |
| carrier fluid | In magnetic particle examination, a fluid in which the magnetic particles are suspended to facilitate their application. |
| central conductor | A conductor passed through a hollow component and used to produce circular magnetization within the component. |
| centrifugal tube settlement flask | A settlement flask used to determine the solids content of magnetic flaw detection inks. |
| circular field | See 'field, circular magnetic'. |
| circular magnetization | Magnetization in a component resulting from current passed directly through the component or through a central conductor. |
| circumferential magnetization | Magnetization that establishes a flux around the periphery of a component. |
| coercive force | The reverse magnetizing force required to remove residual magnetism from a material.<br><br>*NOTE*<br>*The corresponding field intensity value is indicative of the ease of demagnetization.* |

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| coil method<br><br>(coil technique) | In magnetic particle examination, a method of magnetization in which all, or a portion, of the test part is encircled by a current-carrying coil. |
| conditioning agent | A soluble additive to water-based magnetic inks that imparts specific properties such as proper wetting, particle dispersion or corrosion resistance. |
| contact heads | The electrode assembly used for the passage of electrical current through the test part for circular magnetization with the facility to clamp and support the test part. |
| contact pad | A replaceable metal pad, usually of copper braid, placed on electrodes to give good electrical contact, thereby preventing damage, such as arc strikes, to the test part. |
| continuous method | In magnetic particle examination, a method wherein the detecting medium is applied while the magnetizing force is present. |
| contrast aid | In magnetic particle examination, a coating or film applied to a surface to improve contrast by providing a more suitable background. |
| crow receiver | A free standing, graduated measure that is mainly cylindrical but tapered towards the bottom to allow greater accuracy in reading small volumes. |
| core (of an electromagnetic circuit) | That part of the magnetic circuit which is within the electrical winding. |
| Curie point<br>(curie temperature) | The temperature above which ferromagnetic materials can no longer be magnetized or retain their residual magnetism.<br><br>*NOTE*<br>*Examples of such temperatures are : nickel 358 $^{o}C$, iron 870 $^{o}C$ and cobalt 1127 $^{o}C$.* |

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| current flow method | In magnetic particle examination, a method of magnetization by passing a current through a test part. |
| | *NOTE*<br>*The current may be alternating, rectified alternating or direct.* |
| current induction method | In magnetic particle examination, a method of magnetizing in which a circulating current is induced in a ring component by the influence of a fluctuating magnetic field that links the component. |
| detecting medium | In magnetic particle examination, the powder or suspension of ferromagnetic particles that is applied to magnetized test surface to determine the presence or absence of discontinuities. |
| defect | In non-destructive examination, a discontinuity or group of discontinuities whose indications do not meet specified acceptance criteria. |
| demagnetizing coil | See 'aperture type coil'. |
| demagnetizing factor | In coil method, the reduction of the field created by the coil due to the magnetic poles which can be considered to exist at the ends of the component. |
| | *NOTE*<br>*It is a function of the length/diameter ratio of a given component and can be calculated for component having the shape of ellipsoids of revolution. For other shapes it has to be measured experimentally.* |
| demagnetization | The process by which the residual magnetization is reduced to an acceptable level. |

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| **diffuse indications** | **In magnetic particle examination, indications that are not clearly defined.**<br><br>*NOTE*<br>*For example indications of sub-surface discontinuities.* |
| **direct contact magnetization** | A technique of magnetizing in which the current is passed through a component via prods or contact heads. |
| **discontinuity** | **In non-destructive examination, an interruption, which may be either intentional or unintentional, in the physical structure or configuration of a test part.** |
| **direct current** | An electric current flowing in one direction only and sensibly free from pulsation. |
| **dry method** | Magnetic particle examination in which the ferromagnetic particles employed are in the dry powder form. |
| **dryout time** | **In magnetic particle examination, the time allowed for carrier fluid to evaporate, leaving ferromagnetic particles in a dry condition.** |
| **dry powder** | Finely divided ferromagnetic particles suitably selected and prepared for magnetic particle examination. |
| **effective magnetic permeability ( $\mu$ eff)** | In coil magnetization the ratio of the flux density in the component to the applied magnetic field which would exist in the absence of the component.<br><br>*NOTE*<br>*The effective magnetic permeability of a component is not solely a material parameter as it is affected by the demagnetizing factor.* |

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| **electrode** | In magnetic particle examination a conductor by means of which a current passes into or out of the test part. |
| **electromagnet** | A soft iron core surrounded by a coil of wire that temporarily becomes a magnet when an electric current flows through the wire. |
| **energizing cycle** | In magnetic particle examination, the period of application of a magnetizing force to the test part. |
| **evaluation** | In non-destructive examination, a review of interpretations of the relevant indications to determine whether or not they meet the specified acceptance criteria. |
| **examination medium** | See 'detecting medium'. |
| **extenders** | Parts made from ferromagnetic materials that are added to the ends of a test part to increase its effective length for magnetization purposes. |
| **false indication** | In non-destructive examination, an indication obtained through improper technique or processing. |
| **ferromagnetic** | Having a permeability greatly in excess of unity and varying with the flux density.<br><br>*NOTE*<br>*Iron and steel are the most common ferromagnetic materials.* |
| **ferromagnetic particles** | Finely divided ferromagnetic materials used as an aid to the detection of leakage fields on magnetized test parts. |

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| **field, circular magnetic** | The magnetic field surrounding any electrical conductor or component resulting from a current being passed through the conductor or component from one end to another. |
| **field, longitudinal magnetic** | The magnetic field resulting from longitudinal magnetization. |
| **field, magnetic** | The region in the neighbourhood of a permanent magnet or a current-carrying conductor in which magnetic forces exist. |
| **field, magnetic leakage** | The magnetic field that leaves or enters the surface of a component at a discontinuity or change in section, configuration of a magnetic circuit. |
| **field, residual magnetic** | The magnetic field that remains in a piece of magnetizable material after the magnetizing force has been removed. |
| **field, resultant magnetic** | A magnetic field that is the result of two or more magnetizing forces impressed upon the same area of a magnetizable object. |
| **field strength** | See 'magnetic field strength'. |
| **fill factor** | In magnetic particle examination, the ratio of the cross-sectional area of the test part to the cross-sectional area of the encircling coil. |
| **flash magnetization** | Magnetization by a current flow of very brief duration. |
| **flash point** | The lowest temperature at which vapours above a volatile combustible substance ignite in air when exposed to a flame. |

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| fluorescence | In magnetic particle examination, the emission of light by a as a result of and only during absorption of black light (UV-A). |
| fluorescent magnetic particle inspection | The magnetic particle examination process employing a finely divided fluorescent ferromagnetic inspection medium. |
| flux density, magnetic | The strength of the magnetic field, defined as the normal magnetic flux per unit area. |
| flux leakage field | See 'field, magnetic leakage'. |
| flux lines | See 'lines of force'. |
| flux penetration | In magnetic particle examination, the depth to which the magnetic particle flux is effective in the test part. |
| full wave direct current | See 'full wave rectified current'. |
| full wave rectified current | Sensibly direct current produced by rectification of either three-phase or single-phase alternating current, the former method producing a smoother ripple effect. |
| functional test (functioning test) | A test method designed to assess the efficiency of magnetic inks and powders or the performance of equipment. |
| furring | In magnetic particle examination, built up or bristling of ferromagnetic particles due to particles due to excessive magnetization of test part. |

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| gauss | The CGS electromagnetic unit of magnetic flux density and equal to one line per $cm^2$.<br><br>*NOTE*<br>*The gauss has been replaced by the tesla (1 gauss = $10^{-4}$ tesla).* |
| gauss meter | An instrument designed to measure magnetic flux density. |
| Hall effect | A potential difference developed across the conductor, which is at right angles to the direction of both the magnetic field and the electric current, when a current flows along a rectangular conductor subjected to a transverse magnetic field. |
| half-wave rectified current | Pulsed unidirectional current produced by clipping a half cycle from single-phase alternating current. As a result there are intervals when no current is flowing. |
| hysteresis | The lagging of magnetic flux behind the magnetizing field. |
| indication | In non-destructive examination, evidence of a discontiunity that requires interpretation to determine its significance. |
| indirect magnetization | Magnetization induced in a component when no direct electrical contact is made. |
| Induced current method | See 'current induction method'. |
| induced field | See 'indirct magnetization'. |
| inherent fluorescence | Fluorescence that is an intrinsic characteristic of a material. |
| inspection medium | See 'detecting medium'. |

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| interpretation | In non-destructive examination, the determination of whether indications are relevant or non-relevant. |
| keeper | A piece of ferromagnetic material placed across the poles of a permanent magnet when it is not in use in order to complete the magnetic circuit and thereby prevent loss of magnetism. |
| laminated pole pieces | Pole pieces consisting of separately adjustable magnetic elements to enable irregular component profiles to be accommodated. |
| leakage field | See field 'magnetic leakage'. |
| leeches | Permanent magnets or electromagnets that are attached to the electrodes carrying magnetizing current and that are strong enough to hold electrode contact firmly. |
| lifting power | The ability of a magnet to lift a piece of ferritic steel by magnetic attraction alone. |
| lines of force | A conceptual representation of magnetic flux based upon the line pattern produced when iron filings are sprinkled on paper laid over a permanent magnet. |
| local magnetization | magnetization of a prescribed volume or surface of a component. |
| longitudinal magnetization | Magnetization in which the flux lines traverse the component in a direction essentially parallel to its longitudinal axis. |
| magnetic field indicator | A pocket meter that is used to locate or determine the relative intensity of leakage field emanating from a component. |

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| magnetic field meter | An instrument designed to measure the flux density of magnetic fields. |
| magnetic field strength | The measured intensity of a magnetic field at a point, expressed in oersteds or amperes per metre. |
| magnetic flaw detection ink | In magnetic particle examination, a detecting medium consisting essentially of ferromagnetic particles in a carrier liquid. |
| magnetic flaw technique | A technique of magnetization in which the component, or a portion of it, closes the magnetic circuit of an electromagnet or permanent magnet. |
| magnetic flux | The total number of lines of force existing in a magnetic circuit. |
| magnetic hysteresis | See 'hysteresis'. |
| magnetic particle flaw detection | A non-destructive test method utilizing magnetic leakage fields and suitable indicating materials to disclose surface and sub-surface discontinuity indications. |
| magnetic particle field indicator | An instrument, typically a bi-metal (for example, carbon steel and copper) octagonal disk, containing artificial flaws used to verify the adequacy or direction, or both of the magnetizing field. |
| magnetic indication | See 'indication'. |
| magnetic particles | In magnetic particle examination, finely divided ferromagnetic material capable of being individually magnetized and attracted to distortions in a magnetic field. |

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| magnetic particle examination | See 'magnetic particle flaw detection'. |
| magnetic pole | See 'pole'. |
| magnetic rubber | In magnetic particle examination, a special formulated medium, containing ferromagnetic powder, used to obtain castings of component surfaces, with any discontinuity present being reproduced within the replica by a suitable magnetizing technique as a result of migration of the powder within the medium to the position of the discontinuity. |
| magnetic writing | In magnetic particle examination, a form of nonrelevant indication some times caused when the surface of a magnetized test part comes in contact with another piece of ferromagnetic material. |
| magnetizing current | The flow of either alternating or direct current used to induce magnetism into a component. |
| magnetizing force | The magnetizing field applied to a ferromagnetic material to induce magnetization. |
| magnetizing tongs | An accessory consisting of two insulated conductors crossing each other at a common pivot. On one side of the pivot they form the two halves of a single turn magnetizing coil and on the other two handles whereby the coil is made and broken and is connected to the source of current. |
| magnetometer | See 'magnetic field meter'. |
| multidirectional magnetization | The imposition on a component, sequentially and in rapid succession, of two or more magnetic fields in different directions. |

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| non-relevant indication | In magnetic particle examination, an indication not produced by a discontinuity but which is the result of spurious effects such as magnetic writing, changes in section, or the boundary between materials of different magnetic properties. |
| oersted | The CGS unit of magnetic field strength.<br><br>*NOTE*<br>*It has now been replaced by the SI unit ampere/metre.* |
| parallel conductors | Insulated, current-carrying conductors laid parallel to each other close to the surface to be inspected but so arranged that the current flows in the same direction through each conductor thereby producing a substantially uniform magnetic field in the space between the conductors. |
| permanent magnet | A magnet that retains a high degree of magnetization virtually unchanged for a long period of time (characteristic of materials with high retentivity). |
| permeability | The ratio of flux density produced to magnetizing force (the ease with which a material can become magnetized). |
| pole | The area on a magnetized component from which the magnetic field is leaving or returning into the component. |
| polymer technique | In magnetic particle examination, a technique in which a polymer is used as the particle suspension carrier fluid. |

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| powder | See 'dry powder'. |
| power blower | A compressed air device used to apply magnetic powder over the surface of a test part undergoing inspection. |
| prods | In magnetic particle examination, hand held electrodes attached to wander cables to transmit the magnetizing current from the source to the test part. |
| pull-off force | The force that has to be applied to one pole piece of a magnet to break its adhesion to a ferritic steel surface, leaving the other pole piece still attached. |
| reference pieces | A specimen containing known artificial or natural defects used for checking the efficiency of magnetic particle flaw detection process. |
| relevant indication | In non-destructive examination, an indication requiring evaluation. |
| reluctance | A measure of the degree of difficulty with which a component can be magnetized that is analogous to resistance in an electrical circuit..<br><br>*NOTE*<br>*In a material of length l, cross-sectional area A and permeability $\mu$ , the reluctance is given by $l/A\mu$ .* |
| remanence (remanent magnetism) | The magnetic flux density remaining in a material after the magnetizing force has been removed. |
| remanent magnetization tests | Tests to ascertain, either quantitatively or qualitatively, the degree of demagnetization of a component. |

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| residual magnetic field | The field that remains in a ferromagnetic material after the magnetizing force has been removed. |
| residual technique | In magnetic particle examination, a technique whereby ferromagnetic particles are applied to the test part after magnetizing force has been removed.<br><br>*NOTE*<br>*The technique relies for its effectiveness on the strength of the residual magnetic field.* |
| resultant field | See 'field, resultant magnetic'. |
| retentivity | The ability of a material to retain a portion of the applied magnetic field after the magnetizing force has been removed. |
| saturation, magnetic | The stage at which any further increase in the magnetic field applied to a magnetized component will fail to show any significant increase in the magnetic flux within that component. |
| self-demagnetization | An effect occurring in any magnetized component which possesses adjacent free poles (a ring with a gap) that is due to the field between the poles opposing that of the magnetizing force.<br><br>*NOTE*<br>*The effect reduces the strength of the internal field in short components magnetized by the coil technique.* |
| sensitivity | The degree of capability of magnetic particle examination technique for indicating surface or subsurface discontinuities in ferromagnetic materials. |

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| shot | A short energizing cycle in a magnetic particle examination. |
| skin effect | The phenomenon that causes the magnetization produced by alternating current to be contained near the surface of a ferromagnetic materials. |
| split coil | In magnetic particle examination, a single or multi-turn coil constructed with plug connections to allow it to be opened for positioning over test part having no free ends for normal coil access. |
| solenoid | An electrical conductor formed into a coil. |
| sub-surface discontinuity | In magnetic particle examination, a discontinuity situated wholly below the surface of a test part but sufficiently close to the surface to produce broad, fuzzy, lightly held powder patterns. |
| surge magnetization | Use of a high initial current for a short period (less than a second), then a continuous reduced current while the inspection medium is applied. |
| Sutherland flask | A flask used for measuring the apparent proportion of solids separating under gravity from a known volume of magnetic particle flaw detection ink, the ungraduated upper portion, shaped like an inverted pear, being constricted at the top to receive a stopper and blended at the bottom into a graduated tube of small uniform section. |
| suspension | A two-phase system consisting of a finely divided solid dispersed in a liquid. |

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| swinging field | See 'multidirectional magnetization'. |
| **swinging field magnetization technique** | **In magnetic particle examination, a technique that utilizes a form of multidirectional magnetization to enable discontinuities having different directions to be detected in one operation.** |
| tesla | The SI unit of magnetic flux density equal to 1 $Wb/m^2$ of circuit area.<br><br>*NOTE*<br>*It has replaced the gauss (1 tesla = $10^4$ gauss).* |
| test ring | **In magnetic particle examination, a ring specimen containing artificial sub-surface discontinuities which is used to evaluate and compare the overall performance and sensitivity of the technique.** |
| threading bar | See 'central conductor'. |
| through-coil technique | See 'coil method'. |
| true continuous technique | Magnetic particle examination in which the magnetizing current is applied prior to the application of the magnetic particles and is maintained without interruption throughout the examination. |
| UV-A | Electromagnetic radiation having a wavelength in the region 315 nm to 400 nm. |
| UV-A filter | A filter that suppresses visible light and altraviolet radiation other than UV-A. |
| UV-A moniter | An apparatus used for the measurement of UV-A radiation. |

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| visible light | Radiant energy generated in 400 nm to 700 nm wavelength range. |
| wet method (wet technique) | In magnetic particle examination, a method in which the magnetic particles are suspended in a liquid carrier fluid. |
| wet slurry method (wet slurry technique) | In magnetic particle examination, a method in which the magnetic particles are suspended in a high-viscosity carrier fluid. |
| white light | See 'visible light'. |
| yoke | A magnet that induces a magnetic field in the area of a test part that lies between its poles. Yokes may be permanent magnets or either alternating-current or direct-current electromagnets. |
| yoke magnetization | A longitudinal magnetic field induced in a component or a part of a component, by means of an external electromagnet shaped like a yoke. |

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