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شرکت ملی گازایران

مدیریت پژوهش وفناوری

امورتدوین استانداردها

IGS

Iranian Gas Standards

دستورالعمل

بررسی دوره ای کیفیت روغن کمپرسورهای هوا

Periodic Inspection of Used Air Compressors Oil - Part 2

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ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری و رئیس شورای استاندارد

باسلام،

به استحضار می رساند در جلسه ۱۴۷۳ مورخ ۸/ ۸/ ۱۳۹۰ هیأت مدیره، نامه شماره گ۹/۰۰۰/۱۰٤۱۲۵ مورخ ۹۰/۷/۳۰ آن مدیریت درمورد تصویب نهایی استاندارد تحت عناوین ذیل مطرح و مورد تصویب قرار گرفت:

۱- تری اتیلن گلایکول برای نم زدایی پالایشگاه گاز IGS-M-CH-049(0)

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این مصوبه در حکم مصوبه مجمع عمومی شرکتهای تابعه محسوب و برای کلیه شرکتهای تابعه لازم الاجراء می باشد.

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FOREWORD

This code of practice is intended to be mainly used by NIGC and contractors and has been prepared on interpretation recognized standards , technical documents , knowledge , backgrounds and experiences in gas industries at national and international levels .
Iranian gas standards (IGS) are prepared , reviewed and amended by technical standard committees within NIGC Standardization division and submitted to the NIGC's "STANDARDS COUNCIL" for approval .
IGS Standards are subject to revision , amendment or withdrawal , if required , thus the latest edition of IGS shall be checked/inquired by NIGC users .
This code of practice must not be modified or altered by the end users within NIGC and her contractors . Any deviation from normative references and / or well known manufacturers specifications must be reported to Standardization division .
Any comments from concerned parties on NIGC distributed IGS are welcome to technical standards committees and will receive serious attention and consideration should a revision to standards is recommended .

GENERAL DEFINITIONS :

Throughout this code of practice the following definitions , where applicable , should be followed :
1- "STANDARDIZATION DIV." has been organized to deal with all aspects of industrial standards in NIGC . Therefore , all queries for clarification or amendments are requested to be directed to mentioned div.
2- "COMPANY" : refers to national Iranian gas company .
3- "SUPPLIER" : refers to a firm who will supply the service , equipment or material to igs specification whether as the prime producer or manufacturer or a trading firm .
4- "SHALL " : is used where a provision is mandatory .
5- "SHOULD" : is used where a provision is advised only .
6- "MAY" : is used where a provision is completely discretionary .

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CONTENT

1. SCOPE

This code of practice provides guidance on monitoring and maintenance of the quality of the air compressor oil . The purpose of this code of practice is to assist the operator in evaluating the condition of oil and maintaining oil in acceptable condition .
This code of practice gives properties , test methods , warning limits and action for evaluation .

Note 1 : The air compressor manufacturer's instructions should be predominant if available .

2. REFERENCES

Throughout this code of practice the following standards are referred to . The editions of these standards that are in effect at the time of issue of this code of practice (2011) shall , to the extent specified herein , form part of this code of practice . The applicability of changes in standards that occur after the date of this code of practice shall be mutually agreed upon by the purchaser and the supplier.

2.1 Normative References

ASTM D 92 (2005) "Test Method for Flash and Fire Points by Cleveland Open Cup Tester**"**

ASTM D 95 (2005) "Test Method for Water in Petroleum Products and Bituminous Materials by Distillation**"**

ASTM D 445 (2006) "Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)**"**

ASTM D 664 (2006) "Test Method for Acid Number of Petroleum Products by Potentiometric Titration**"**

ASTM D 665 (2006) "Test Method for Rust Preventing Characteristics Inhibited Mineral Oil in the Presence of Water**"**

ASTM D 974 (2004) "Test Method for Acid and Base Number by Color-Indicator Titration**"**

ASTM D 1401 (2002) "Test Method for Water Separability of Petroleum Oils and Synthetic Fluids**"**

ASTM D 2272 (2002) "Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Bomb**"**

ASTM D 2273 (2005) "Test Method for Trace Sediment in Lubricating Oils**"**

ASTM D 3427 (2006) "Test Method for Air Release Properties of Petroleum Oils**"**

ASTM D 5185 (2005) "Test Method for Determination of Additive Elements , Wear Metals , and Contaminants in Used Lubricating Oils and Determination of Selected Elements in Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)**"**

ISO 4406 (1999) "Hydraulic Fluid Power – Fluids – Method for Coding the Level of Contamination by Solid Particles**"**

2.2 Informative Reference

ASTM D 6224 (2009) "Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment**"**

3. TESTS AND THEIR SIGNIFICANCE

The tests provided in Tables 1 and 2 are considered to be sufficient to determine whether the oil condition is adequate for continued operation and to suggest the type of corrective action required .

3.1 Appearance

The appearance of oil may show cloudiness which may indicate the presence of gross contamination of water or solids , or both .
The appearance of the oil shall be clear bright , and free from suspended matter and sediment when a representative sample of oil is examined in an un-colored , clean glass bottle and with transmitted light under an oil depth of approximately 100 mm and at ambient temperature .

3.2 Viscosity

The measuring of viscosity may signify that oil is contaminated , severely degraded or wrong oil .

3.3 Acid Number

The neutralization value increasing is as a result of oxidation ageing and as a general guide for determining when an oil should be replaced .
It is a measure of the acidic constituents or contaminants in the oil .
The acid number may represent which oil is wrong .

3.4 Water

The presence of water indicate entry water with air stream and potential water leak from the atmosphere that contaminant the oil .

3.5 Oxidation Stability

The value of oxidation stability decrease may be show which oil is approached to the end of its service life .

3.6 Flash Point
The changes in value of flash point may be signify the presence of probable contamination or severe degradation .

3.7 Insolubles
The presence of insolubles may be indicates either oil or additive is degraded . It may be shows contamination of oil by equipment wear or other debris too .

3.8 Water Separability
The increase of the time for separation water from oil may be specify that oil is contaminated or degraded .
When the demulsified depleted , water doesn't intend to separate from oil .

3.9 Rust Evaluation
The fail in value of rust may be indicate which additives is depleted or it is show the presence of excessive contamination .

3.10 Particle Counts (cleanliness level)
The source of particle counts may be make–up oil , dust , ash or wear condition .

3.11 Wear
The presence of wear particle concentration may be imply wear condition .

3.12 Wear Debris Analysis
The wear condition may be indicated by wear debris analysis when the presence of wear particle is recognized .

3.13 Elemental Analyses
The changes in value of elements may be indicate that additive is nearly depleted or precipitation .
It is also shows either the wrong oil is added or oil is diluted .

4. OIL DETERIORATION AND DETECTION

4.1 Deterioration

Oil in service is in contact with contaminants (like material used in the construction of equipment , oxidation reaction products , water , …) which may change the characteristics of oil . The following mentioned contaminants may be found in oil in service . The presence of any kind of deterioration changes one or more of the properties discussed as follows :

4.1.1 Air
Oil in contact with air is subject to oxidation reaction and therefore acidic compounds and foam may be formed and color may be changed . There may be increasing in the viscosity and decreasing in the viscosity index .
Either metals or dissolved metallic compounds as catalyst accelerate oxidation reactions .

4.1.2 Water
Water presence may affect the characteristics of oil . It may be originate from atmosphere .

4.1.3 Solid particles
Solid particles may originate from the conditions of service of the equipment . They are also may be produced by oxidation or degradation of oil .
These products can cause abrasive wear of appurtenances of equipment and reduce filter life . Strength of oil may be reduce by presence of these particles .

4.1.4 Soluble components
These products may be formed by materials used in the construction of equipment or may be result of oxidation of oil itself .
The presence of these contamination can be indicate by acid number .

4.2 Detection

The detection is detailed in Tables 1 and 2 which gives characteristics , warning limits , test methods and required action if necessary .

5. SAMPLING

The sampling shall be carried out in accordance with the clause 6 of ASTM D 6224 .

6. HEALTH , SAFETY AND ENVIRONMENTAL PRECAUTIONS

6.1 In general , PPE (Personal Protective Equipment) and other protective clothing should be worn by all personnel when working on work site and work with air compressor machine . Also wearing the appropriate protective clothing and using correct equipment for maintenance and checking the oil of air compressor is mandatory.

6.2 A copy of MSDS (Material Safety Data Sheet) of air compressor oil to be held on work site when working with air compressor machine .

6.3 Spills or leakage of air compressor oil should be avoided during sampling and testing .

6.4 Compressor oil samples and used chemicals should dispose off after the test completion , considering appropriate methods and according to local regulations .

Table 1 – Recommended Tests for Inspection of Air Compressor Oil in Service

Item	Property	Unit	Warning Limit	Test Method	Recommended Action	Frequency of Test [1)]
1	Appearance [2)]	---	Cloudy , visible debris , not clear and bright	Visual (see clause 3.1)	Perform further analysis to identify contaminant . Investigate cause and remedy . Filter or centrifuge oil .	Weekly
2	Kinematic viscosity at 40 °C	mm^2/s (cSt)	± 10% of new oil	ASTM D 445	Determine cause . If viscosity is low , determine flash point . Change oil .	See note 3
3	Kinematic viscosity at 100 °C	mm^2/s (cSt)	± 10% of new oil	ASTM D 445	Determine cause . If viscosity is low , determine flash point . Change oil .	See note 3
4	Total acid number (TAN)	mg KOH/g	Increase of 0.2 of new oil	ASTM D 664 or ASTM D 974	Look for increased sediment on filters or centrifuge . Change oil if RBOT is less than 25% of new oil . Test more frequently if oil is left in system .	See note 3
5	Water content	wt %	Increase of 0.05 of new oil	ASTM D 95	Investigate cause and remedy . Centrifuge oil or use vacuum dehydration , or change oil .	See note 3
6	Insolubles	wt %	More than 0.3	ASTM D 2273	Centrifuge or filter oil , or consider oil change .	See note 3
7	Additive elements analysis	mg/kg	± 25 % of new oil	ASTM D 5185 [4)]	Consider changing oil . Consult with oil supplier regarding situation .	See note 3
8	Air release at 50 °C	minute	More than 20	ASTM D 3427	Change oil .	See note 3

1) If the results of each of these tests are close to warning limits , increase frequency of testing .

2) Appearance includes obscurations such as color , clarity , odor , and sediment .

3) The specified time for continuously operated equipment shall be 1500 hours . The frequency of test for non continuously operated equipment shall be three month and for standby equipment shall be six months .

4) Another spectrochemical method such as rotating disk electrode (RDE) , atomic absorption (AA) or X-Ray fluorescence (XRF) may be substituted for the ICP method .

Table 2 – Optional Tests for Inspection of Air Compressor Oil in Service

Item	Property	Unit	Warning Limit	Test Method	Recommended Action
1	Oxidation stability (RBOT)	minute	Less than 25% of new oil	ASTM D 2272	Consider oil change or consult with oil supplier regarding reinhibition . Consider also the total acid number .
2	Flash point (COC)	°C	Decrease of 20 °C of new oil	ASTM D 92	Determine cause . Check other parameters (such as viscosity) . Consider oil change .
3	Water separability	minute	More than 30	ASTM D 1401	Centrifuge , filter or purify by other process , consult with oil supplier and/or change oil .
4	Rust preventing characteristics	---	light fail	ASTM D 665	Consult with oil supplier regarding reinhibition or change oil .
5	Cleanliness level	---	17/14	ISO 4406	Locate and eliminate source of particulates . Filter or centrifuge oil .
6	Wear particle concentration	mg/kg	see note 1)	ASTM D 5185 2)	Perform wear debris analysis .
7	Wear debris analysis	mg/kg	see note 1)	ASTM D 5185 2)	Investigate source of particles and make necessary maintenance or operational changes .

1)Recommended warning level is a concentration of two standard deviations above the mean of six or more prior results . In cases where there are insufficient analysis results to provide a good baseline or in cases where the increase in concentrations is steady but gradual , the equipment manufacturer should be consulted for guidance .

2) Another spectrochemical method such as rotating disk electrode (RDE) , atomic absorption (AA) or X-Ray fluorescence (XRF) may be substituted for the ICP method .