



ABSTRACT

In the first part of the column, we presented the advantages of performing DGA analysis in an in-house laboratory. However, nowadays, most of the DGA and insulating tests are performed in an outsourced external laboratory, usually in another country and even continent. Despite the advantages presented in the first part, according to the majority of organizations around the world, outsourcing the major insulating oil tests is a better decision for the industry. Some important reasons for this shift from in-house to outsourcing will be presented.

Part 3, to be published in the next TM issue, will offer a couple of guidelines on selecting the best oil lab for processing your oil samples from the aspect of a user. Regarding the laboratories, some suggestions on how to attract more users will be provided. Hint: the price is not everything.

Online and portable devices are today a popular choice for a DGA test, but as one of the pillar veterans of the industry stated in a private discussion, “acquiring any online device may, in reality, cause an increase in offline DGA tests”. At the

time, he said that portable multi-gas devices had not yet existed. After many years of experience, I understood that he was correct, although some online device companies tried to convince users that online devices would reduce the frequency of DGA in laboratories. In many aspects, portable devices possess more characteristics of online devices than that lab devices.

KEYWORDS:

DGA, outsourcing, in-house analysis, comparisons, review

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Where to perform the dissolved gas analysis? - Part II

1. Introduction

Until the beginning of the present millennium, most DGA tests were performed in internal laboratories. This was the situation before the privatization of the electrical industry all over the world. In the ante-privatization epoch, the internal budgets for routine maintenance, resupplying, and hiring valuable employees, which also included electrical and oil labs, were practically unlimited. Wise and devoted management of large monopoly companies is invested in the development and the methodological and academic enrichment of the facilities and technical staff. This attitude was reformed during the privatization process. This process has imposed a drastic reduction of nondirected activities to electrical generation, and one of the worldwide mottos was to outsource as many resources as possible. Oil laboratories were one of the first “victims” of this attitude, and most internal oil labs were indeed shut down. Lube oil laboratories were the first ones, and insulating oil labs came after or concomitantly. A small number of new energy companies organized a central service provider association belonging to a few companies and even a few countries.

These maintenance centres included an oil laboratory, but the first mission was to provide services to the owners. External customers were only accepted as the second option. Few other in-house laboratories opened for external customers and became profitable by themselves. In such a market situation, the already existing independent laboratories had a huge advantage of being more experienced and knowledgeable in providing insulating oil tests to external customers looking to outsource their oil tests. A good example of this advantage is the situation in the USA and Canada’s markets. Because the USA was one of the first countries that privatize its energy industry sector, the commercial insulating oil labs in the USA and Canada flourished early, and now they provide services in many parts of the world. This is maybe in contrast to the power transformer industry in the USA, which was based mainly on imports. Nowadays (2022), it also seems that oil labs of US-based companies are more adapted to the competitive market, which is reflected worldwide. Of course, oil test quality and real added value to the clients are less related to successful market behaviour.

Disclaimer: Because of the sensibility of commercial issues and to preserve neutrality, no specific company of actual DGA providers will be mentioned in this column. I will only use general continent identifications, mainly because different countries have different test policies. Of course, this column will not recommend using any internal or external DGA service provider. Each case should be customized according to specific needs.

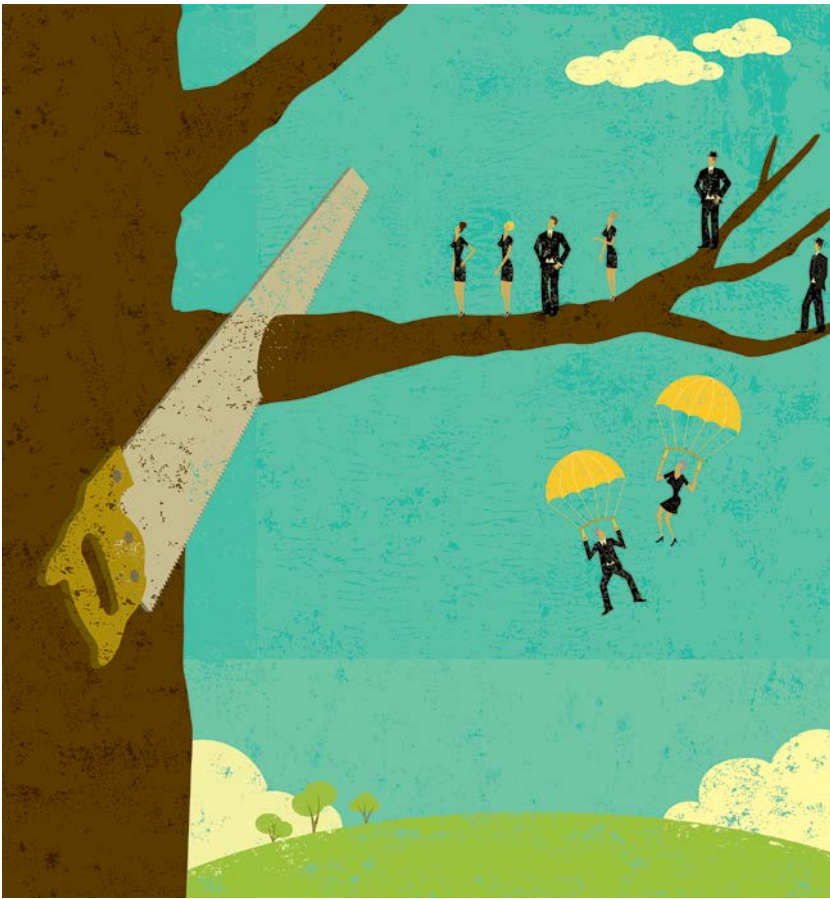
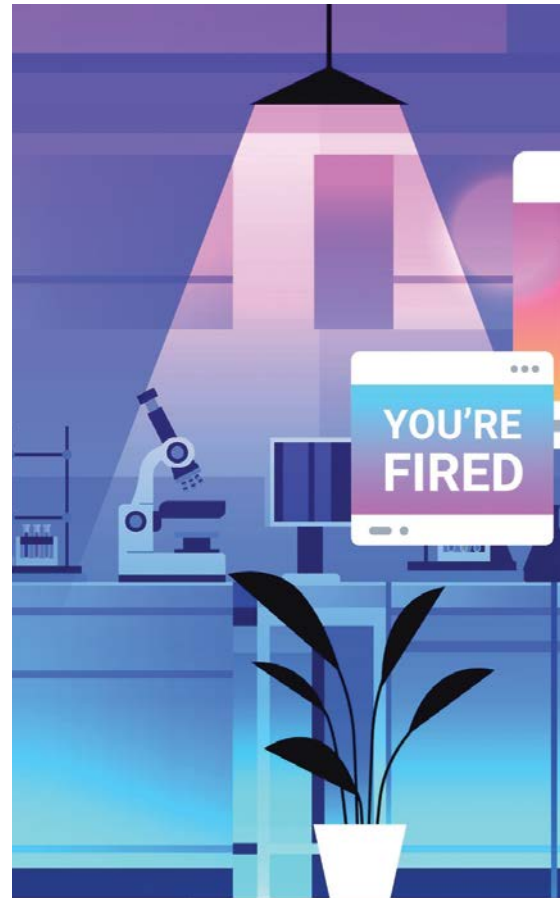


Illustration of privatization process usually occurring in major countries



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2. Oil test specialist employment

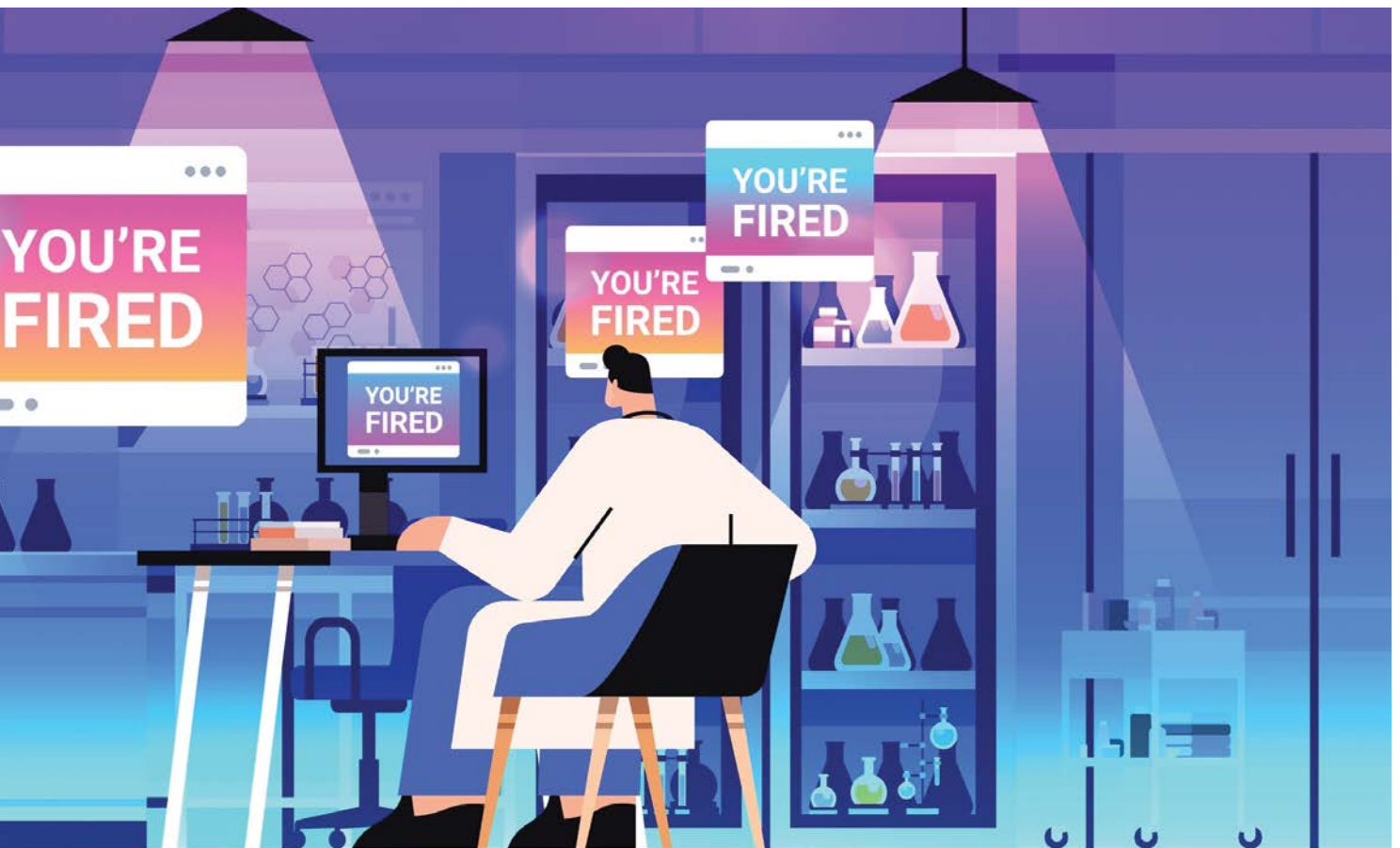
Oil test specialists have become a rare species as an occupation, although the demand and need for this discipline are growing everywhere. Before the privatization era, most oil specialists (mainly chemists who specialized in analytical chemistry) were well-employed by governments' energy companies, which held the monopoly. Of course, as the activities at their labs ceased, most of them were dismissed or retired. A minority have remained working until their retirement. But without an active lab, it is less plausible to share the knowledge with the next generation.

Some specialists found work in commercial oil labs, but of course, a small number of such labs have their own personnel. The main attribute of internal lab employees is the opportunity to be exposed to a large fleet of transformers, get involved in the maintenance policy, oil test procedures, sampling of their own transformers, and, if needed, internal inspection. Of course, post-mortem transformer analyses improve the prospect diagnostic capacity. This type of holistic activity is a characteristic of a monopoly that may afford to sustain and reward such occupations. In small companies, the usefulness of such activities is less appreciated, mainly because in the short term, they are still covered

by their existing experienced specialists.

Commercial testing laboratories are focused mainly on the quality of oil tests because most clients directly order these tests. Indeed, laboratories invest large funds in quality assurance and continuous analytical education but less so in the correlation between oil tests themselves and the practical meaning of these tests. Those profitable laboratories may be compared with medical laboratories in hospitals, which must provide reliable and accurate tests and, not to mention, be aware of the consequences of those tests.

A special class of laboratories that used to exist a long time ago and still exist in the transformer and material facilities are laboratories that still employ oil tests specialist and preserve the knowledge through generations. However, most of them do not provide external test services to general clients. In the same way, major insulating oil companies have sophisticated instruments and qualified chemists but do not provide external services. A good example is a



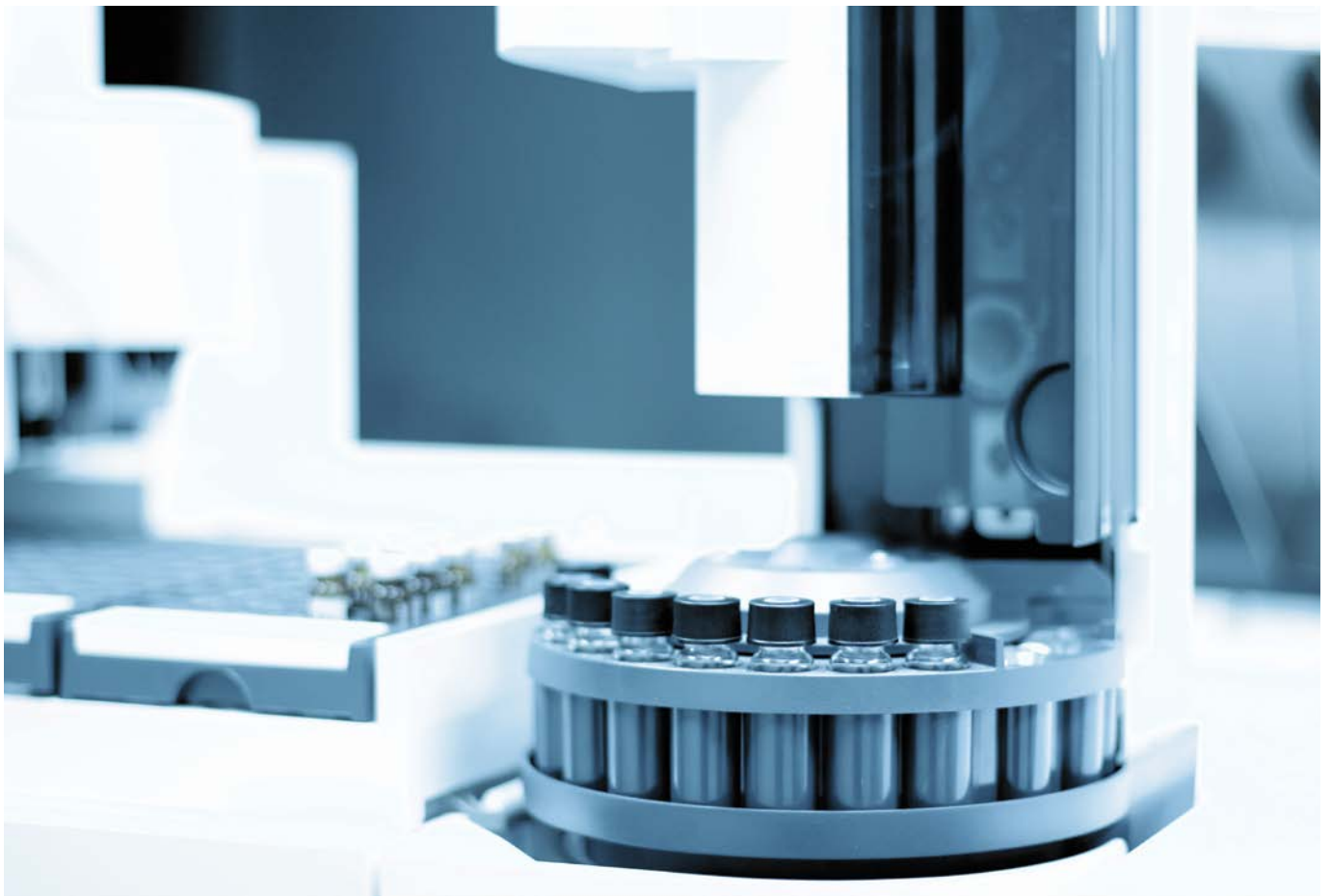
well-known oil producer who opened a lab chain several years ago. Unfortunately, it closed a couple of years later.

3. Advantages of an outsourced laboratory

1. Money. Due to the large number of oil tests processed annually, the cost of the tests themselves is reasonable and fits the financial capacities of most transformer owners. Large laboratories can afford to acquire robotic and automated test instruments. These advanced instruments allow for the performance of unmanned tests, thus facilitating a substantial reduction in prices. For example, most modern DGAs accommodate approximately 50 samples per day in a maximum of two man-hours for a skilled technician. Most other oil tests may also be performed by chemical instrument robots. Once a laboratory acquires such an expensive instrument, it may perform tests 24/7, and the cost per sample decreases proportionally to the increase in the number of performed tests.

The advantages of outsourced laboratories are the lower cost, higher quality, updated test methodology, valuable final diagnosis, and many more





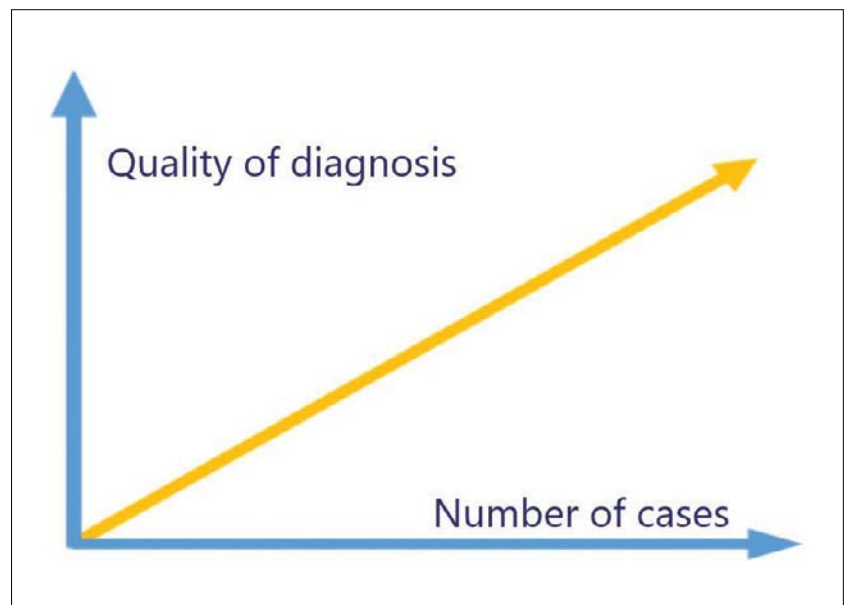
Vials on an auto sample of gas chromatography in a laboratory – the unmanned device can process over 50 samples a day

3. Updated test methodology. Profit-making oil laboratories always implement the most modern analytical oil tests and are at the forefront of research and technical development. Their senior staff are even obligated to actively participate in the most relevant international conferences and work study groups of standardization organizations such as IEEE, ASTM, CIGRE, IEC, and others. The same as in the academic environment. Commercial oil lab management requires them to bring back the latest methodologies from such meetings, for example, methanol and ethanol tests, for the assessment of thermally upgraded insulating cellulose. This technology was discussed approximately eight years ago, and it has been gradually adopted by large commercial oil labs that could afford to invest in expensive chemical instruments and allocate highly experienced and knowledgeable chemists to implement this new technology. Of course, the motivation is not just purely academic. Marketability motivation is surely legitimate, and funds always encourage the availability of knowledge. In the best case, a low-bud-

get in-house organization with a lab of a modest category, in the best case provides only essential oil tests and relies on outsourced laboratories for non-routine ones.

4. Valuable final diagnosis. Given the availability of a large oil test database, the quality of the final diagnosis is

definitely a result of accumulated experience. Oil test experts employed in large commercial laboratories are able to analyze a wide variety of oils from different types of transformers and other electrical instruments. In-house personnel is normally exposed only to their own limited-specification transformers and insulating material.



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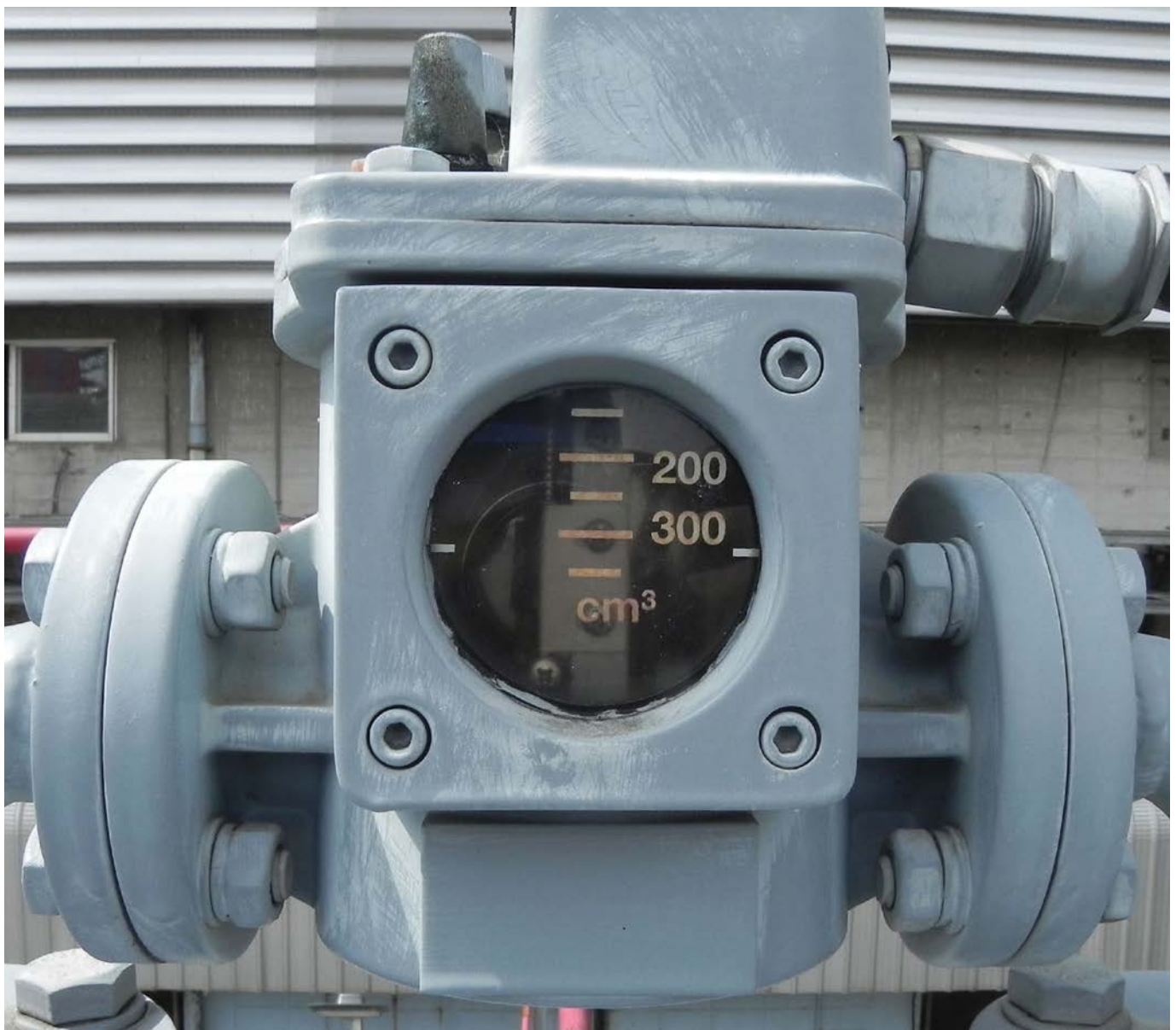
5. Emerging insulating materials. If a new type of insulating liquid needs to be tested, it is always better to send it to a laboratory that has prior experience with this specific oil type. The user will have direct advantages from already the accumulated experience of the commercial laboratory.

6. Flexibility of service providers. According to actual specific tender conditions, the user may always switch between different laboratories

according to their own satisfaction level.

7. Solution for emergencies. As described in part 1, one of the advantages of in-house labs over external ones is the fast response time of the in-house lab. This is particularly important during emergencies. The disadvantage of a remote laboratory nowadays may be easily solved by utilizing a portable DGA device for a large fleet or for critical and / or very important trans-

formers by adequate DGA online devices. The online DGA device may be installed on a failure-suspected transformer until clarifying the state of the transformer is. Some online DGA devices allow the connection of numerous transformers to a single DGA device. The testing frequency is obviously different, but even so, the DGA tests are performed much more often than in any offline laboratory. This is not a recommendation for using online DGA devices in such a manner.



Picture of a Buchholz relay— an alarm from this device calls for an urgent DGA



8. Test data vulnerability. Another important issue presented in part 1, as the advantage of an in-house laboratory over external laboratories, is data safety outside an organization. If the transformer data and conditions are distributed outside the organization, they may be at a higher risk, even if the external location is supposed to be secure. Hackers or disloyal personnel may jeopardize the security of valuable data. Together with their condition, transformer specifications may be used by enemies or competitors as weak points. To be on the safe side, users may restrict the main identification details provided to the external lab. It is possible to use different types of independent diagnostic software

from independent companies for providing diagnosis and assessment based on the oil test data. Of course, human transformer experts engaged by the transformer users are a safer and recommended choice.

4. A short summary and conclusions

Large commercial oil laboratories may perform DGA and all other oil tests for large fleets, or even single transformers, cheaper, better, more reliable, and by more advanced methods compared to typical small-size in-house labs. Outsourcing oil test assignments is an attractive, feasible, and more economical solution for the majority of transformer

users, at least in the short and medium term. Keeping internal oil labs is, in most cases, an unjustifiably expensive privilege that even may be harmful to the equipment itself if the laboratory is not continuously modernized and the staff is not frequently exposed to the latest scientific and technological development in the industry. Critical reaction time, especially for DGA tests, may be easily resolved by taking advantage of an adequate portable or online DGA device. This may also be considered if there is a requirement for dissolved moisture in oil measurements. Other oil tests do not usually have to be done so frequently.

Large laboratories and corporate energy establishments should encourage

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and support adequate investment in the education and preservation of oil test specialists. Similar to investments in the education of electrical engineers specialized in high voltage. It is highly recommended to invest and encourage students to choose the analytical chemistry discipline, get employment in this



An easy and fast-reacting portable device which allows providing quick response indication in the case of the emergency



An online device for critical transformers

field and improve the level of insulating oil testing laboratories. As we are all well aware, the energy sector is no less important than the internet sector, and specialists of all disciplines serving our important industry should be preserved, continually educated and, first of all - well rewarded. Privatized energy companies may also hire an experienced insulating oil chemist in the absence of an operating lab and consider this profession essential to the electricity supply industry.

In the third part of this continuous column, recommendations for selecting the best-outsourced lab will be provided to the users, as well as advice for laboratories on how to attract more clients.

Author



Marius Grisar holds an MSc in Electro-Analytical Chemistry from the Israel Institute of Technology. He has almost 30 years of intense experience in almost all transformer oil test chains, from planning, sampling and diagnosis to recommendations and treatments, mainly in Israel but also in other parts of the world. He is responsible for establishing test strategies and procedures and creating acceptance criteria for insulating liquids and materials based on current standardization and field experience. In addition, he trains and educates electrical staff on insulating matrix issues from a chemical point of view. He is an active member of relevant Working Groups of IEC, CIGRE, and a former member of ASTM. He is also the author and co-author of many papers, CIGRE brochures, and presentations at prestigious international conferences on insulation oil tests, focusing on DGA, analytical chemistry of insulating oil, and advantageous maintenance policy for oil and new transformers.