

PRACTICAL GUIDELINE

AUTOMOTIVE WARRANTY MANAGEMENT

for suppliers



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INTRODUCTION

Warranty is a topic that receives more and more attention from OEM's and suppliers. Why? Because measurably its proper management translates into a reduction in the company's costs in this area.

In the below eBook You will learn about the basic terms used in warranty management and how it relates to the requirements of the IATF. You will also learn about risk analyzes types and strategies for the tactical operation of the Flying Doctor.

In addition, I present in it methods of managing No Trouble Found, which if it appears in the TOP 5 of all problems, clearly affects costs from the warranty filed.

I hope You will like the form and content. More information is available on the website automotivequal.com

Best regards,

Dariusz Kowalczyk



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1 Automotive warranty management – basic terms

Current IATF requirements focus not only on monitoring quality complaints from customer plants, but also on [automotive warranty management](#). The two main points that realize these are following: 10.2.5 – Warranty management systems and 10.2.6 – Customer complaints and field failure test analysis.

It should be remembered that above is also an input data for management review in accordance with point 9.3.2.1 (subpart h).

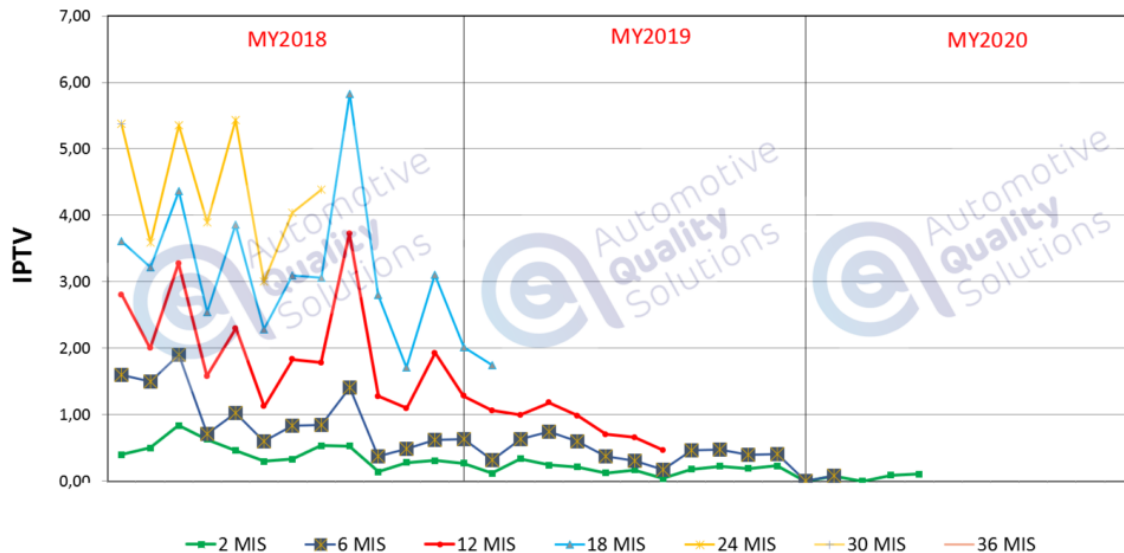
In this case, few basic terms should be identified:

[IPTV \(en. Incidents Per Thousand Vehicles\)](#)

Also known as the **C1000**. This indicator determines the number of problems reported by final customers visiting the dealer stations. This does not automatically mean the replacement of components. In this case dealer can for example, only update the software, lubricate interface elements, or perform their additional tightening.

The starting point for defining the above-mentioned indicator is a joint work which is carried out by the customer's engineering and the organization of the reliability plan, which corresponds to the implementation of APQP point 1.4. Product and process assumptions.

From the IATF's point of view, the reliability plan is included in the requirement 8.3.5.1. defining output from design and development. An example of a graph showing the relationship of IPTV to MIS is presented below.



Picture 1. IPTV to MIS relationship

TF (Technical Factor – %)

Defines the percentage share of the organization's financial responsibility for the parts replaced by the dealer that are covered by the warranty period. From the supplier's point of view, this is a key indicator that directly translates into poor quality costs.

Defining its value should start immediately after **SOP** (start of production) with the analysis of the first parts. Usually the first meetings with clients regarding defining of **Technical Factor** take place a few months after the project is launched. In this case is already analyzed several dozen parts (of course, it can be more which is more advantageous for the organization).

To the final evaluation is taken into account:

- the number of parts analyzed in a given period
- number of parts for which a defect can be assigned for supplier responsibility
- the number of parts for which no defect from final customer has been confirmed (NTF – explained below).

It is also worth remembering that TF is not an indicator that is defined once. Depending on the achieved quality performance, this value may be reduced (in case of actions implemented by the organization for identified defects) or increased. Second case will be related to chronic problem assigned to the process, subcomponents or design. Such issue should be analysed in automotive warranty management activity by organization with big attention.

NTF (No trouble found)

No confirmation of the defect. The term used when analyzing warranty returns, for which, after performing standard tests, no defects indicated by the end user were found. Depending on the customer (**OEM**) additional requirements related to NTF may be applied. For the VW group, additional requirements are defined in the “**VDA – Field Failure Analysis**” manual.

On the other hand, in case of the Stellantis-FCA group, if the warranty is managed as part of the Tutorship, NTF is determined during the tests carried out

before sending back the parts to the supplier. For this client the reference document which should be used in such activity is: CQI-14 Automotive Warranty Management.

Months in Service (MIS)

Defined as the time period during which the vehicle is used by the end customer. The usual assumption is that 30 days of use is equivalent to the index unit (30 days = 1.0 MIS). When working with a Ford customer, it is worth remembering that it is referred to as **TIS: Time-In-Service**.

The most popular time periods are: 3 months (3 MIS) when the incident occurred, counting from the date of vehicle purchase by the end customer until issue reporting to the dealer, 12 (12 MIS) and 24 (24 MIS) months. Nevertheless, customers such as VW, GM and Ford give the opportunity to see the performance even for one month.

In summary, each person in the organization who is responsible for managing warranty returns should familiarize themselves with the above terms in order to correctly understand the links between them and identify their impact on the potential financial invoices.

2. IATF warranty requirements – how to identify

IATF requirements pay more attention to the product quality, not only from the customer's plant complain point of view, but also to the performance in relation to the vehicle using by the end customer.

For this reason, anyone in an organization who deals with warranty returns should identify the main IATF requirements that focus on this area. These include, among others:

- 8.5.5.2 Service agreement with customer
- 9.3.2.1 Management review inputs – supplemental
- 9.1.2.1 Customer Satisfaction – Supplemental
- 10.2.5 Warranty management systems

8.5.5.2 Service agreement with customer

If a service agreement has been defined with the customer, the organization should verify that the respective service centers are compliant with their requirements. In addition, it is the organization's responsibility to provide training for service personnel, if required.

Most often in this case you can meet with the so-called a diagnostic procedure that determines what diagnostic activities should be performed by a service station using appropriate tools and equipment. This is primarily to eliminate the

possibility of replacing components, which then, during the analysis by a given production plant, do not show any problems with their functioning.

Such part is known as no trouble found (NTF). Of course, NTF translates into an appropriate warranty invoice costs, which in this case is shared 50% / 50% between the client and the organization. By implementing the appropriate diagnostic procedure, the organization eliminates the possibility of an increased occurrence of parts with the NTF status, thanks to which it ultimately translates into a reduction in warranty costs.

9.3.2.1 Management review inputs – supplemental

The warranty returns area must be included in the management review input. It covers two main topics:

- results on warranty returns and
- identifying potential warranty returns as part of a risk analysis (such as FMEA)

From a performance point of view, the most rational approach is to verify that our warranty performance meets the customer-defined goal. We can focus here both on the target in terms of effectiveness (indicators: IPTV, MIS, C1000, R1000) and efficiency. The latter is most often managed through the evaluation of debit notes that are issued by customers in relation to the number of parts sold in a given period.

In case of identifying potential returns from the field, it seems reasonable to use FMEA as a risk analysis because even the FMEA manual itself considers at least 3 defects: operations (internal notifications), customer (0-km claims) and the end user (warranty claims).

9.1.2.1 Customer Satisfaction – Supplemental

If we manage field returns in organization, we must remember that we should monitor customer satisfaction regarding warranty returns (which must be included in the management review), field returns and recalls. At this point, it is worth distinguishing between the warranty and field returns. A warranty return is a component that is replaced by the dealer considering the agreed period of use of the vehicle or its mileage.

On the other hand, the return from the field is the part that is over the warranty period, but the customer, for some reasons, asks for its verification. In practice, this concerns scenarios related to security or with a large number of occurrences assigned for one type of failure mode, which causes degradation of the system over time.

10.2.5 Warranty management systems

The above requirement indicates that if an organization is involved in the analysis of parts from the field, it must apply the approach based on meeting the

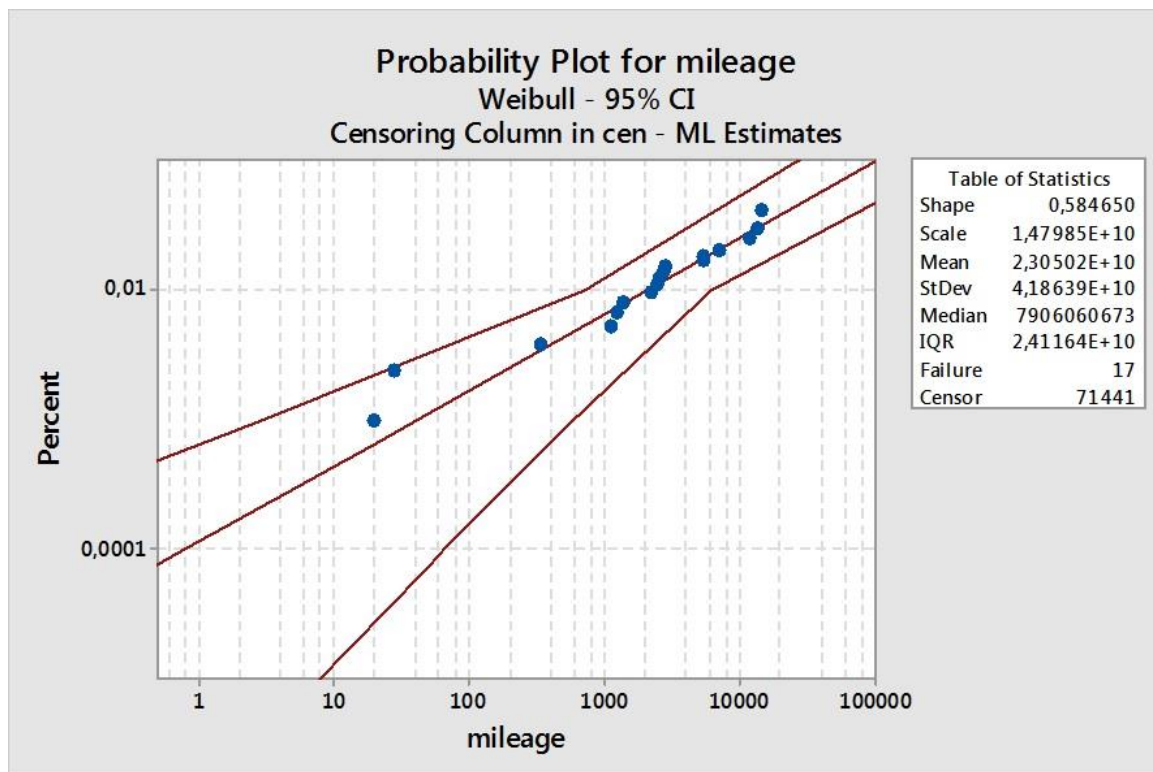
requirements for the part for which no problem was identified after its analysis
– NTF.

Additionally, some customers require additional reference manuals for the evaluation of warranty parts. In practice, the Stellantis-FCA group requires using of CQI-14 “Automotive Warranty Management”, and German customers (Daimler, VW, BMW) require VDA Field Failure Analysis.

3. Weibull analysis in automotive warranty management – introduction

Weibull analysis should be applied by organization when probability of failure changes over time. In practice it's applied in the case of issues which don't appear directly in the production plants (e.g. during PPAP tests), but start to occur in the warranty field.

Special attention when organization should investigate of Weibull analysis preparing is information about increased problem occurrence in the warranty field.



Picture 2 – Weibull data presentation in MiniTab.

Depending on the parameters, it can assume a normal distribution as well as exponential distribution ($k = 1$).

The k parameter distribution determines the behavior of the probability of failure over time and it's distinguished on three category:

- for $k < 1$ the probability of failure decreases over time.
- for $k = 1$ (exponential distribution) the probability is constant. This suggests that failures are external random events.
- for $k > 1$ the probability increases with time – parts functionality is degradation over time

The reason why it should be used is to provide to customers risk analysis of the potential number of defective components that may still occur in the warranty field.

In practice, two factors are taken into account:

- mileage after which the final customer noticed the improper functioning of the system
- time after which the problem was noticed by the final customer

It should be also remembered, that each analysis must be approached individually. The following information is examples of the most commonly used assumptions:

- European market daily mileage: 50 km
- Japanese market daily mileage: 30 km

It's also possible to estimate the average daily mileage if the organization has a significant population of defective components. Thanks to this assumption, it's possible to estimate the number of defective parts in relation to the duration of the warranty time and mileage covered by the warranty period.

The output from Weibull analysis should be evaluation of range with minimum and maximum quantity of defective units which are still founding in the field basing on which both client and organization can determine next steps. The above information is possible to identify based on the below chart.

4. PPM analysis – statistical risk assessment for 0-km and warranty returns

In case of quality problems that are not one single occurrence, we may be required by client or organization to prepare a risk assessment related to potential non-conforming products population.

One of such assessments is the PPM analysis, which takes into account the dependence of affected parts quantity in relation to a million manufactured parts (PPM – parts per million).

Its unquestionable advantage is the fact that it can be used to carry out risk assessment both for units reported from the customer's production plants (0-km) and from the warranty. By the organization, it's most often applied in the following situations:

- inability to use process data that could help define the affected population
- drawing values are changed during the production process without the possibility of their reconstruction. For example shaft diameter on which are pressed the bearings.

In order to use it, you do not need any additional software (as in the case of the Weibull analysis, for example) – a standard Excel form is enough.

PPM analysis – assumptions

Each risk analysis is based on assumptions that must be considered in its preparation. We have to remember that it should be included in the documentation presented to the client or within the organization.

In the case of PPM analysis, such assumptions include:

- Start date defining from which we are able to identify the beginning of the problem. If this is not possible, the start date will be equal with Start of Production (SoP) of particular project.
- Closing date defining that corresponds to the date of permanent corrective action (PCA) introduction.

These two dates are our cut-off points that define the time range which will be considered during the preparation of the risk assessment.

- It can be applied for minimum two returned units. Complaint for assigned failure mode which we deal with only for one returned unit is presented as “one single occurrence”).
- It requires an appropriate update when the organization receives new parts for analysis.
- It is considered on a monthly basis. For all months including the risk assessment, we should receive information from the logistics department or directly from customer portals about number of parts shipped. It should be both for months for which no defective parts were

found and for those where such parts were reported by the customer as non-conform.

Document overview

In above risk assessment, we will use four columns that contain the following names:

- “Month”
- “Returned units” assigned to individual months
- “Shipped units” shipped in individual months
- “PPMs counted” that are only calculated for months where no problem was identified. The formula for this factor is as follows:

$$\frac{\text{Returned units}}{\text{Shipped units}} * 10^6$$

Discussed form is illustrated in the below example. As we see start date is July and the end date is March. This is the time period which will cover nine months in total.

The number of returned units is considered for the following months: July, October, December, January, February, March – 42 in total. For the remaining months, we will calculate PPM based on the results from the “PPMs counted”

column.

Month	Returned units	Shipped units	Ppm's counted
07/15	1	53133	18,82069524
08/15	15,1742319	56162	
09/15	11,06306932	40946	
10/15	2	47025	42,53056885
11/15	14,34989193	53111	
12/15	8	52789	151,5467237
01/16	14	51816	270,1868149
02/16	13	55804	232,9582109
03/16	4	30241	132,2707582

$\frac{\text{biggest ppm's} \times \text{shipped units}}{10^6}$

$\frac{\text{Returned units}}{\text{Shipped units}} \times 10^6$

82,58719314 - Estimated quantity of returned units

estimated quantity of problems for other months with the biggest month's ppm

Table. PPM analysis – calculations example

In the “Shipped units” column, we insert the monthly amounts obtained from the logistics department or customer portals. On the other hand, the last column “PPMs counted” is used to calculate the values for the months in which defective units appeared.

The most important element of the PPM analysis is to include the highest value in the next step from the “PPMs counted” column. It has to be done as the “worst-case scenario”.

Analysis final stage is PPMs calculation for months: August, September and November using the following formula:

$$\frac{\text{biggest ppm's} \times \text{shipped units}}{10^6}$$

By this, we can calculate the final number of parts that will be considered in the risk assessment. In the above case, the number is equal 82.58 and must be rounded to 83.

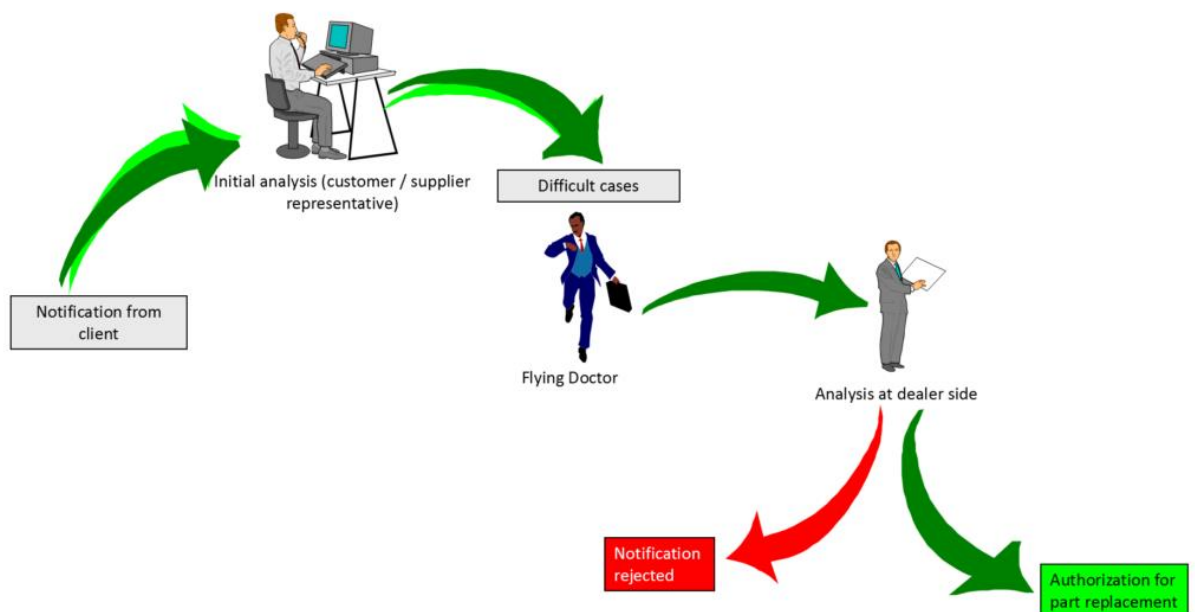
In the documents provided to the customer (OEM), it's also worth including the statement, that the potential number of affected units is equal 83, of which currently have been identified 42. Potentially 41 parts remain in the warranty field or at the customer's plant.

5. How Flying Doctor can improve automotive warranty performance

Flying Doctor (Man in the Van) activity in [automotive warranty](#) performance can play strategic role in improving main KPI's (for example: IPTV – incident per thousand vehicles, TF – technical factor , CPU – cost per unit, number of warranty returns).

The most important advantages are listed below:

- Their activity allows early diagnosis of the problem and its analysis directly at dealer side. By this approach organization doesn't have to involve their resources if this person will be hired outside of organization – see below sketch.



From the point of view of the Technical Factor defining results for analyzed part with an unconfirmed defect, have an impact on the

percentage of rejected parts that reduces the supplier's share in the involved costs

- Before visiting the dealer, it is essential that Flying Doctor has all the knowledge about the part that will be analyzed (providing all necessary information based on traceability).
- Thanks to this, it is possible to automatically reject the complaint in case of identifying the exchanged components outside of organization plant (see example on the next page).
- Flying Doctor must be equipped with full diagnostic equipment provided by the organization's plant (software, laptop, stethoscope, camera, optionally part for replacement).

[How to start the implementation](#)

When organization will consider activating such approach, it's important that Flying Doctors, in order to verify the components directly at the dealers will perform dedicated training at the plant producing the particular components, which will include the following areas:

- Product training (for example performed by product support engineers)
- Training on the production line to familiarize the Flying Doctors with the assembly processes.
- Training of previously recorded quality problems covering both 0-km and field returns.

- Training in electrical diagnostics (department dealing with the analysis of electrical problems); if the organization produces electronic components
- Optionally training in mechanical diagnostics, which carries out road tests of returned components in the car environment.

They can be also used in another areas as well to support organization. In this point it worth to remember that Flying Doctor can also verify how the dealer handle the service parts, in order to exchange them for the defective part. It is important in the case of non-compliance for problems that occur within a short period of time after the installation in the car service part.

In such situations Flying Doctor can conduct training at a particular dealer service station, and as systemic action OEM can send to the dealer service stations information on the correct way of components handling. Base on this we're showing to client our proactivity which has positive impact on long term relationship building.

6. VDA FFA – introduction to field failure analysis

The vast majority of companies supplying components to the automotive industry must be aware that in addition to production dedicated directly to the customer's production plants (O-km).

They are also often produced service parts that are directly related to automotive warranty management.

IATF requirement that refers to the above is point 10.2.5 "Warranty management systems", which in addition to identifying definition of NTF -No Trouble Found informs about additional customer requirements in this area of activity.

In the case of German customers, such information is presented, among others, in the following documents:

- VW Group: Customer Specific Requirements which can be found in IATF referred to point 10.2.5, which directly relates to the implementation of NTF using the VDA FFA manual.
- BMW: standard GS 95004 "Failure analysis – Part analysis of field complaints"
- Daimler: MBN 10448 "Field Failure Analysis"

It is also worth remembering that the last two customers in the documents cited have relevant requirements which are informing the supplier about possibility of field returns process auditing.

Such audit is performed directly in production plant by customer representatives. Therefore, acting preventively, it is worth considering the introduction of FFA audit as part of process audit in addition to the requirement 9.2.2.3 from the IATF.

During warranty issues discussion, we should not forget about the liability issue, which is defined after analyzing the root causes for a given warranty part. It is divided, among others, into the following areas:

- **Responsibility for design** – for example in the VW group, where the organization is responsible for the project (co-design) the KVV factor will be between 10 to 90%. However, if the project is submitted for realization by the customer, the KVV is reduced to 20-30%. Of course, other configurations are also possible depending on the agreed contractual provisions between the parties.
- **Responsibility for the manufacturing process** – 100% of the costs are incurred in this case by the organization when the defined root cause relates directly to the non-compliance assigned to the production process.
- **Responsibility for instructing** – specifying whether in case of a problem from the warranty field (or directly reported by the manufacturing plant) was organized by organization in advance meeting with the customer. The purpose of this activity is to present and approve the way of parts handling in order to avoid their damage.

For example, holding wires from parts may cause plug disconnection and finally electrical fault in the car. Such requirement is in the MLA form at level 5. The point that should be discussed with the client in this area is recognized in section 5.4.1.

When organization should start to planning field failure analysis process

The activity related to warranty parts analysis should be started in the pre-launch phase when carrying out MLA, which, depending on the defined risk in the project (A, B, C), is carried out by the client or organization. This requirement is defined in MLA level 4. The point that should be discussed with the client is defined in section 4.2.5 (there is also referred VDA FFA document as well).

However, in case of activity related to the escalation of the problem in the project, customer can perform an audit during pre-launch phase basing on process audit according to VDA 6.3 which will cover sections 2, 3 and 4. Why is this so important? Because in section 3 and 4 there are questions related to process planning for analysis of warranty returns and its implementation (points 3.4 and 4.7 respectively).

Another situation occurs when an internal production audit is carried out, which organization for current production should carry out 1/12 months. In this case, the question 7.4 will be assessed, which is equivalent to the questions from sections 6 and 7 of the FFA audit form.

7. No Trouble Found - effective management strategies

No Trouble Found (NTF) is the result of a qualitative analysis stating that the problem has not been confirmed. If the Pareto analysis shows that it's the main contributor to warranty returns, then it's worth implementing strategies that will reduce its occurrence.

Why? Because even if the customer approves our analyzes with a No Trouble Found result, 50% of the costs will be covered by the supplier. For this reason, it is good to know the strategies to reduce costs resulting from an excessive amount of warranty returns with this status.

Diagnostic Procedure - a filter for No Trouble Found

This is a great strategy for reducing pieces with NTF status. It's a joint check list arrangement between the customer's engineering department and supplier. It consists the individual diagnostic steps performed by the dealer to confirm that the problem is connected with supplier component.

In this way, some clients (for example, Stellantis-FCA) are introducing new criteria for financial liability for such parts. In practice, this means that the supplier will not be charged for any costs related to NTF.

Stellantis-PSA also makes it possible to jointly define the procedure relating to the elimination of NTF returns. It's not defined as "diagnostic procedure" but nevertheless the final benefits are these same.

[Flying Doctors launch strategy](#)

Flying Doctor (Man in the Van) is an activity that should be planned over the long term. By employing a given specialist in such a position, the plant has the opportunity to implement several tactical strategies for reducing NTF. More information is presented in a separate article.

[Additional evidence collected by dealerships](#)

One of the tactical actions I used when managing warranty returns was obtaining additional evidence from the dealer. The activity consists in agreeing with the customer's representative, who has been assigned to this activity, that the given dealer station will present additional information in this regard before sending the complained part to the supplier. The complaint areas for which we can reduce the number of No Trouble Found occurrences are:

[No Trouble Found for Noise Complaints](#)

In this case, the dealer is obliged to send an additional video showing the type of noise. It would be best if we also received information about the speed, tires type and the car version in which the problem was detected.

Why? Such data may be used in the future to build an information base, thanks to which it's possible to establish a correlation between a given type of defect and the conditions under which it occurred.

Car "drift" notifications

Such problems will concern, in particular, components related to the suspension and the vehicle steering. One of the steps that the dealer can do before the suspect part is returned to the supplier is to verify the wheel alignment. It's carried out in two steps.

- step 1: checking the wheel alignment at the beginning of the analysis
- step 2: wheel alignment re-calibration in case of deviation and verifying whether the problem is still present

Let the data speak

Another strategy that can be analyzed together with the customer is the verification of the assembly process at the customer's site.

This scenario will be very likely where the end customer doesn't find a problem after obtaining part of the NTF. Remember that this part is replaced by the dealer. This may mean that the problem is originally related to an incorrect part assembly at the car manufacturer.

Therefore, as suppliers, we should conduct a joint analysis with the customer's representative for this area. It should start from the incoming warehouse itself, through sequencing (optional), and ending at the assembly line.

What can we check?

- the way how our component is handled
- sequence of the components screwing. For example, a steering column for the dashboard or seats to the car body.
- checking the nominal values for the torque and angle data

Summary

I hope that the presented material will help you better understand the warranty requirements.

In the near future, the warranty will be a very important element with a measurable impact on suppliers' costs. In addition, customers are starting to extend complaints from the 0-km area to warranty returns (i.e. not only costs but also official complaints will be on the KPI scope).

For this reason, it's so important to learn about the strategy, reporting, launch, management, types of risk analysis, tests, reference manuals and internal communication regarding warranty activities.

Additionally, it is a very good starting point for building a long-term relationship with the client.

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P.S. If you have any questions, please do not hesitate to contact me:
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