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Mack Rides service bulletin relating to NDT on rail and channel guided rides

NAFLIC is in receipt of a service bulletin put out by Mack Rides relating to the company's rail and channel guided rides. The bulletin specifically covers the conversion of the evaluation basis from operating hours to operating cycles for the recurring non-destructive testing of metallic components of rail and channel guided devices.

If readers of this item have any queries, they are advised to contact Mack Rides directly for further information.

The bulletin is published here in full.

The information contained within is that of the manufacturer and not NAFLIC. When following the advice from the manufacturer, you are reminded of your duties and responsibilities under HSG175 regarding modifications.

Service Mitteilung / Service Bulletin

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Hersteller / Manufacturer:	Mack Rides GmbH & Co KG
Anlagenname / Ride name:	all rail- and channel-guided rides
Betroffene Produktionstermine: Affected production dates:	
Modell Nummer / Model number:	

Conversion of the evaluation basis from operating hours to operating cycles for the recurring non-destructive testing of metallic components of rail- and channel-guided rides.

The determining criterion for the non-destructive testing is the maximum number of starts performed by a vehicle during a mean operation year. This value determines the scope of the yearly testing.

In order to avoid exceptional stresses, all available vehicles must be put into operation equally.

Should a defect be discovered during the non-destructive testing, all identical components of the ride must immediately be tested. Stop the operation of the ride immediately and contact Mack Rides for instructions on the course of action.

Document the tests carried out accordingly in test reports.

Some parts are assigned an identification number, in accordance with Mack company standard MR-WN-0030. Reference the tested parts correspondingly in the test documentation, using their complete designation (all letters and numbers).

Example of part identification:



For the non-destructive testing, the parts to be tested must be completely uninstalled.

Reapply corrosion protection / varnish on all surfaces where the treatment has been removed for testing purposes. Refer to the manufacturer specifications (corrosion protection matrix) and requirements related to friction coating and contact surfaces. Refer to specific coating information in attached drawings.

Parts damaged by corrosion must be immediately repaired or replaced.

After reinstalling the tested part, carry out a functional test of the respective assembly, as instructed in the present document.

Carry out a visual inspection of all of the parts listed in this section, irrespective of their operation time, every time the opportunity arises – for example during a bearing replacement. Check for defects such as run-in marks, dents or tears. Exchange the affected parts accordingly.

Depending on the manufacturing process of the specific parts to be tested, the following norms and standards for non-destructive testing must be observed.

Test method*		Norm to be applied	Assessment according to	Acceptance class	Staff	quality
Welded parts						
VT1****	Visual testing	DIN EN ISO 17637	DIN EN ISO 5817	B **	EN ISO 9712	level 2 ***
MT1	Magnetic particle testing	DIN EN ISO 17638	DIN EN ISO 23278	1 **	EN ISO 9712	level 2 ***
PT1	Penetrant testing	DIN EN ISO 3452-1	DIN EN ISO 23277	1 **	EN ISO 9712	level 2 ***
Machined parts (without welding seam)						
VT2	Visual testing	DIN EN 13018	DIN EN 13018	**		level 2 ***
MT2	Magnetic particle testing	DIN EN 10228-1	DIN EN 10228-1	4 **	EN ISO 9712	level 2 ***
PT2	Penetrant testing	DIN EN 10228-2	DIN EN 10228-2	4 **	EN ISO 9712	level 2 ***

- * all listed norms and standards can be replaced by equivalent or higher level local norms and standards
- ** no linear indication is acceptable
- *** qualified and certified personnel
- **** only for new parts - the first ND test can be carried out visually, provided the respective part is entirely visible. All subsequent tests must then be carried out as MT or PT, as applicable.

All the parts listed in the previous document must be completely tested, as specified herein. As soon as a testing cycle comes to an end, the next testing cycle begins, for all the parts listed in the document. Carry out the subsequent test cycles in the exact same order.

If more than one test is listed, anyone can be chosen. The choice of procedure lies with the ride controller.

Depending on the type of ride and vehicle, the number of parts installed in the various assemblies may vary. The vehicles of a ride fleet may also differ in number of axles, seats or other components. The decision regarding the point in the testing cycle at which a certain vehicle should be tested lies with the controller.

Operational procedures and life phases

The range of NDT is defined by two parameters:

1, Operating cycles of the ride

Rides with higher numbers of cycles are to be more tested than rides with less cycles.

2, Higher-cycle range and operating life of the components

Above a certain number of cycles, the component is in the higher-cycle fatigue range.

According to EN 13814, ISO 17842 or ASTM F2291 the boundary of the higher-cycle range (= life phase 2) is the minimum of 35.000 operating hours.

The boundary between the life phase 1 (< 35.000 h) and the life phase 2 is defined by the operating environment, such as:

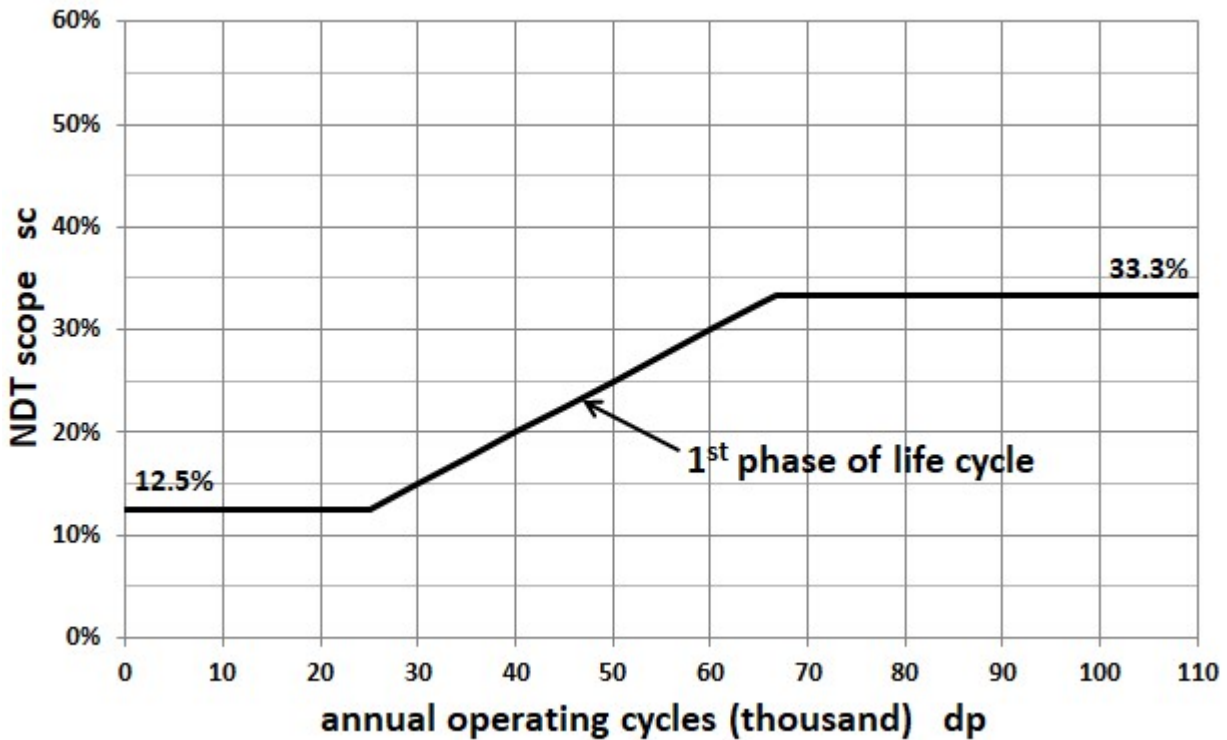
Operating environment:	boundary between life phase 1 and 2:
ride in year-round park:	10 years
ride in seasonal park:	20 years
ride in summer park (less than 120 operating days/year):	30 years
transportable ride, traveling funfair, carnival:	30 years
transportable ride in park	accord type of park

With slow running rides ($v \leq 3$ m/s) and damage-tolerant structures the life phase 2 is to be neglected.

Scope of testing – life phase 1

The NDT interval for rides in the life phase 1 is between 3 years (33,3%) and 8 years (12,5%). The yearly scope is calculated as follows:

$$sc = \frac{dp}{200.000} \begin{matrix} \geq 12.5\% \\ \leq 33.3\% \end{matrix}$$



The number of the ND-tested parts per year n_{NDT} is calculated with reference of the total number n , as:

$$n_{\text{NDT}} = sc \times n$$

This calculation is sufficiently exact with 4 parts or higher. For smaller number of parts the scope of testing is to be adapted as follows:

number of parts		1	2	3	4
max. NDT interval:		3 years	6 yrs.	6 yrs.	8 yrs.
min. yearly. NDT scope:	sc	33.3%	16.7%	16.7%	12.5%
min. number of NDT parts	n _{NDT}	0.33	0.33	0.5	0.5
min. NDT interval:		1 year	2 yrs.	2 yrs.	3 yrs.
max. yearly. NDT scope:	sc	100.0%	50.0%	50.0%	33.3%
max. number of NDT parts	n _{NDT}	1	1	1.5	1.5

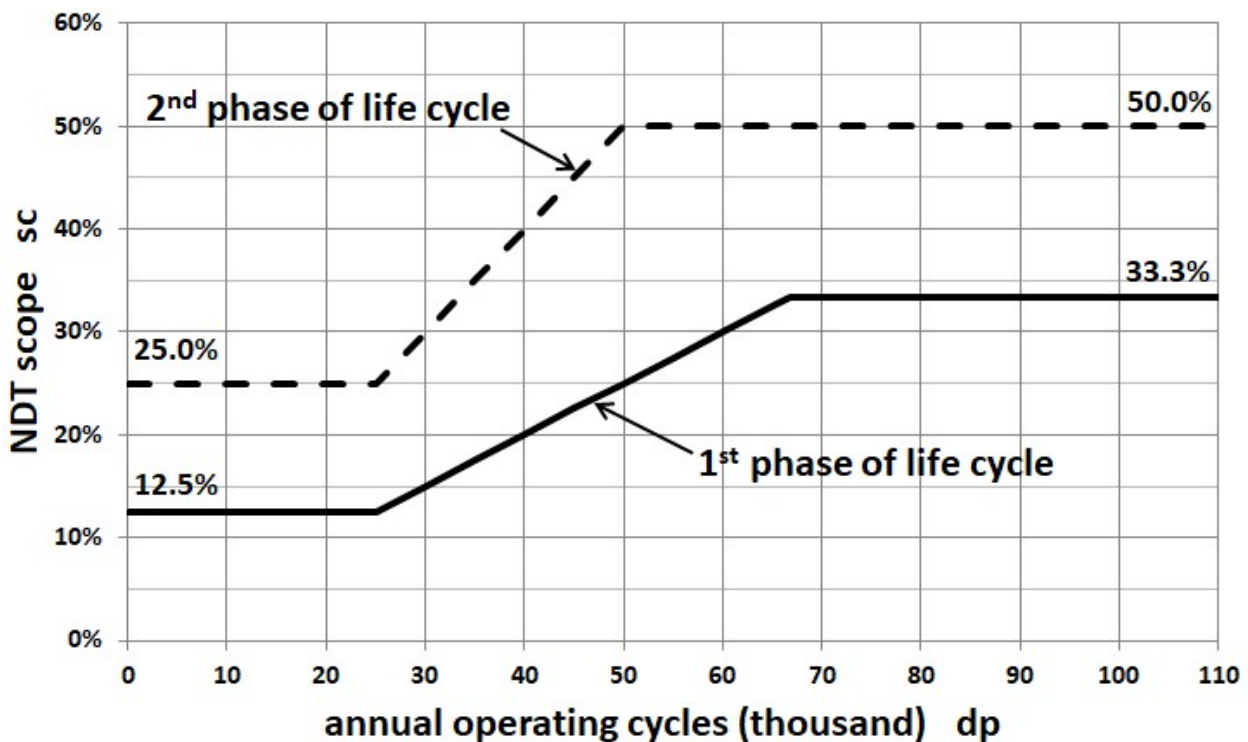
A number of units subject to inspection of 0.33 per year means that the unit would have to be inspected every 3 years (corresponding to 0.5 every 2 years). With few units and low operating numbers it can therefore be that between the NDT tests more than one year elapses.

An obligation to test 1.5 units means that 1.5 units per year would have to be tested. In the following evaluations, rounding algorithms are integrated that lead to half-digit units. Thus, if 7.5 units were subject to inspection, the operator could alternately inspect 7 units in one year and 8 units in the next.

Scope of testing – life phase 2

For older rides the NDT interval will be doubled to the life phase 1, whereas 50% will be the maximum scope. The yearly scope for the life phase 2 is calculated as follows:

$$sc = \frac{dp}{100.000} \begin{matrix} \geq 25.0\% \\ \leq 50.0\% \end{matrix}$$



For smaller number of parts (< 4) the scope of testing is to be adapted as follows:

number of parts		1	2	3	4
max. NDT interval:		2 years	4 yrs.	4 yrs.	4 yrs.
min. yearly. NDT scope:	sc	50.0%	25.0%	25.0%	25.0%
min. number of NDT parts	nNDT	0.5	0.5	1	1
min. NDT interval:		1 year	2 yrs.	2 yrs.	2 yrs.
max. yearly. NDT scope:	sc	100.0%	50.0%	50.0%	50.0%
max. number of NDT parts	nNDT	1	1	1.5	2

Recommended approach for the implementation of this new directive:

- 1, determine the actual life phase by means of the operating years and the environment.
- 2, determine the yearly scope of testing by means of the current life phase and the actual number of cycles per vehicle.

For any question or comment do not hesitate to contact us any time.

Mack Rides GmbH & Co KG

i. A.

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