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VIBRATIONS MEASUREMENTS

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ABSTRACT

This work is based by a study about some vibrations measurements done at the 175 MW hydro aggregates which equip the "Portile de Fier I" hydro central. The measurements were done in 1979, between 19 and 21 of December according to STAS 6910-74.

The work presentation is computed under Visual Basic and come to help the people who want to have data and interpretations of vibrations measurements at 175 MW hydro aggregates.

THE BLOCK DIAGRAM OF MEASUREMENTS INSTALLATION, PROCESSING OF VIBRATIONS DATA AND INTRODUCTIONS OF INFORMATICS ELEMENTS

The measurements were done for the following load conditions:

- 1. Working at 10 MW
- 2. Working at 90 MW appreciated as 50% from maximum load
- 3. Working at 175 MW considered as maximum load
- 4. Working at an over load of 187 MW

The measurements were done on 3 directions X,T and Z. The measured bearings were:

- the upper radial bearing LRS
- axle box cover CLA
- the bottom radial bearing LRI

The attaching of the transducer on these 3 bearings and the 3 directions were magnetically done.

Taking in account that the rotating frequency of hydro aggregates is 1,192Hz corresponding to a rotating of 71,5 rot/min, the main problem was to do a special measurement chain for detecting of vibrations which were produced with the rotating frequency of the groups.

Because the most known checking instruments had the lower frequency limit of 2 Hz there were used other instruments with better characteristics.

The used transducer was an acceleration one, KB12 type, made by RFT Company. The characteristics of this transducer were:

- a very good sensitivity: 250 mV/ms^-2
- frequency range at 100 M: 1-250 Hz
- weight: 180 g

Registering of vibrations charts was done in the ranges:

1) f=0,71–5,6 Hz which contain the rotation frequency of turbine axle f=1,192 HZ

2) f=5,6-16 Hz which contain the rotation frequency multiplied by the rotor blades number f=7,15Hz

3) f=16-45 Hz which contain the superior order frequency f=28-29 Hz

4) Charts with global unfiltered values of amplitudes (Tab I)

The analysis of getting results was done in correlation with the values from STAS 6910/74.

Because the vibrations from STAS 6910/74 are periodical vibrations with constant amplitudes, the estimation of getting vibrations amplitudes was done on frequency bands, considering the frequency of 1,19 Hz for the first frequency band, the frequency of 7,15 Hz for the second band and the frequency of 29 Hz for the third band.

The getting global values were used for a comparative analysis of the results at different stages.

Because the groups work in parallel and the perturbations have some similar frequency spectrums interactions between them appear and they are shown in the charts as some clatters. Also, it appears accidental perturbations caused by some hydraulic effects. Taking in account these reasons, the inconstant amplitude which varies between some limits, there are used the following parameters for evaluation of results:

X_{med} μm - average amplitude at an interval of 1minute, for this stage was used the mention chain, so the average value vas calculated from cca 120 values

X_{max} μm - maximum amplitude in the same interval

f_p Hz – average frequency of vibrations in the analyzed range of frequencies

After that, there are shown the chart and the table from which we can extract the comparative conclusions between the vibrations levels in different points measurements.

For the results analysis in frequency band f=0,71-56 Hz, STAS 6910-74 defines the next grades:

very good : 0-64 μm

good : 64-99 μm

admissible: 99-148 μm

keeping under observation: 148-199 μm

1st group(fig. 1)

- values of 10 MW on Z direction
- values of 175 MW on X and T directions
- smallest values of amplitudes at 90 MW

Group I

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	75.20	73.00	28.50	23.00
90	26.56	18.00	16.70	8.70
175	41.50	37.20	57.80	79.70
187				

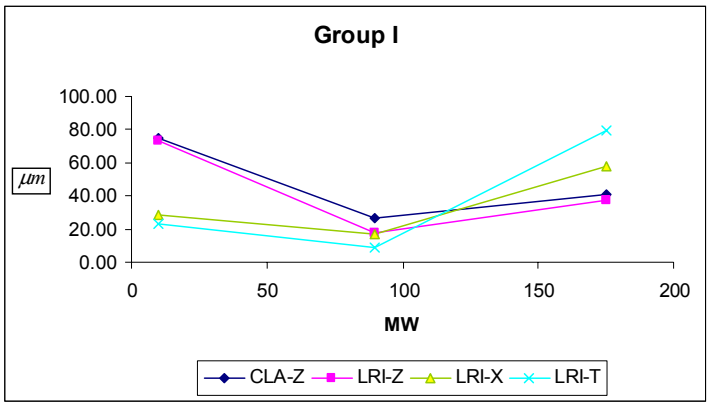

fig. 1

2nd group:(fig. 2)

- bigger values at 10 MW on Z direction
- smaller amplitudes at 187 MW than at 175 MW
- smallest values of amplitudes at 90 MW as at the 1st group

Grup II

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	93.40	96.00	107.3	56.80
90	13.40	15.40	16.00	13.10
175	37.40	47.00	49.30	35.00
187	35.00	45.50	15.6	16.40

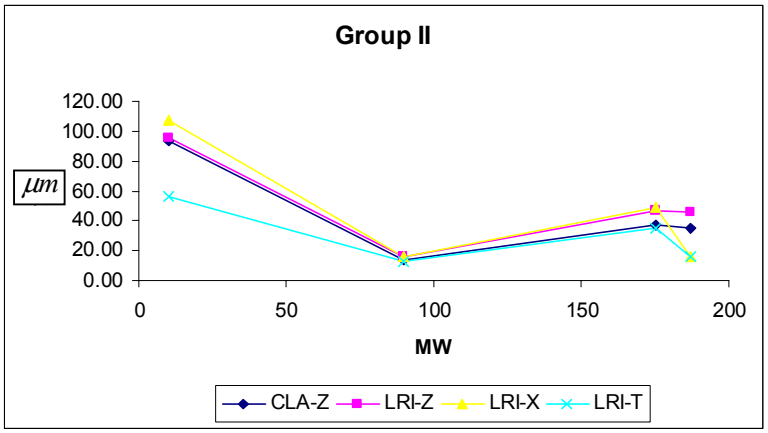

fig. 2

3rd group:(fig. 3)

- bigger values at 175 MW on X direction
- much smaller values at 187 MW than at 175 MW
- minimum values of amplitudes at 80 MW

Grup III

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	9.80	123.80	32.50	26.20
90	21.10	21.30	13.50	14.30
175	41.40	61.00	92.50	55.00
187	43.00	41.00	18.20	16.20

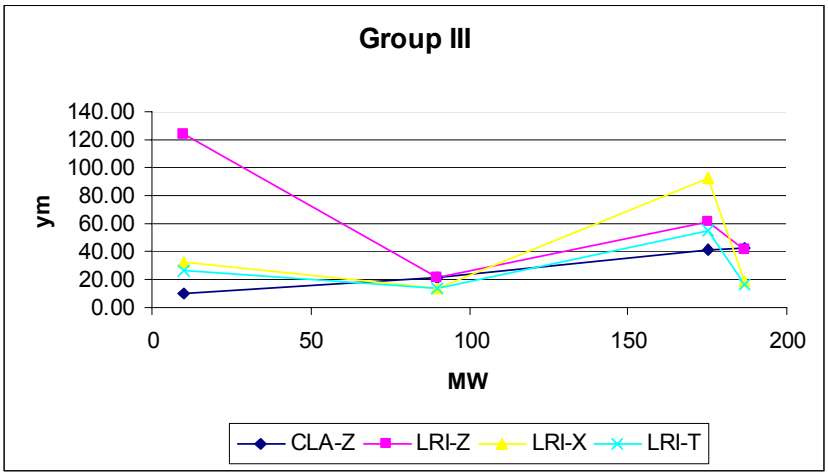

fig. 3

4th group:

- big values at 10 MW on Z directions at CLA
- bigger values at 175 MW on Z, X and T directions at LRI
- small values at all loading cases on T direction

Grup IV

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	92.70	83.10	33.70	23.70
90	37.70	36.50	15.60	24.80
175	43.30	50.30	31.00	32.00
187	44.00	35.60	25.00	20.00

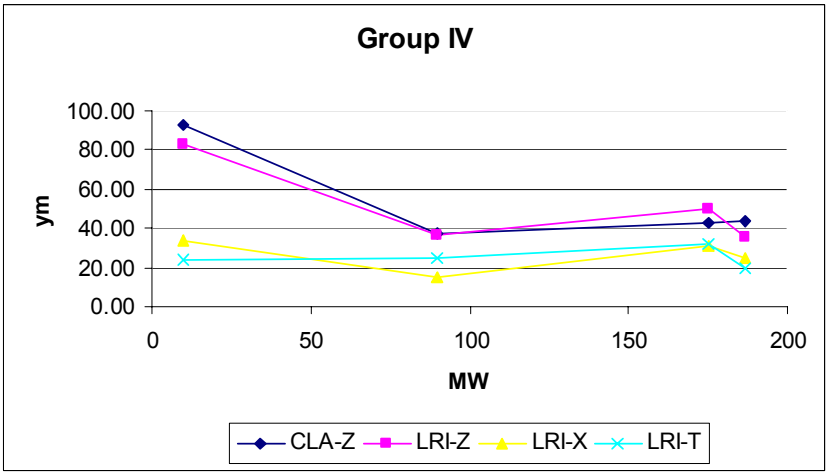

fig. 4

5th group:(fig. 5)

At this group all amplitudes values are classed in the range “very good” , at this group were obtained the smallest values from all the groups.

Grup V

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	50.20	48.00	13.40	15.60
90	50.50	59.50	21.60	21.60
175	55.60	57.50	13.70	
187	64.50	62.40	23.40	17.40

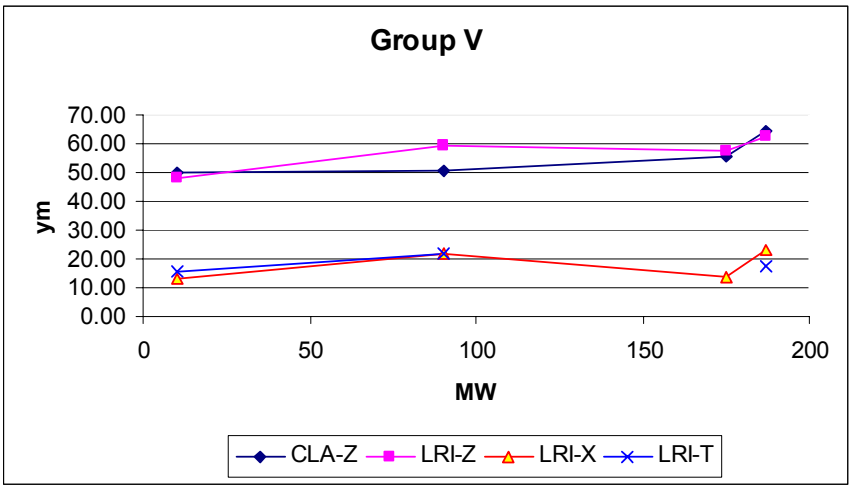

fig. 5

6^{th} group(fig. 6)

- big values at all loading cases on Z direction at LRI
- biggest values at 10 MW, at all bearings on all directions from all groups
- small values at 90 MW

Grup VI

	CLA-Z	LRI-Z	LRI-X	LRI-T
10	70.60	99.00	30.50	38.80
90	58.20	45.40	16.20	12.00
175	48.20	51.00	15.00	12.10
187	48.30	49.30	26.70	17.00

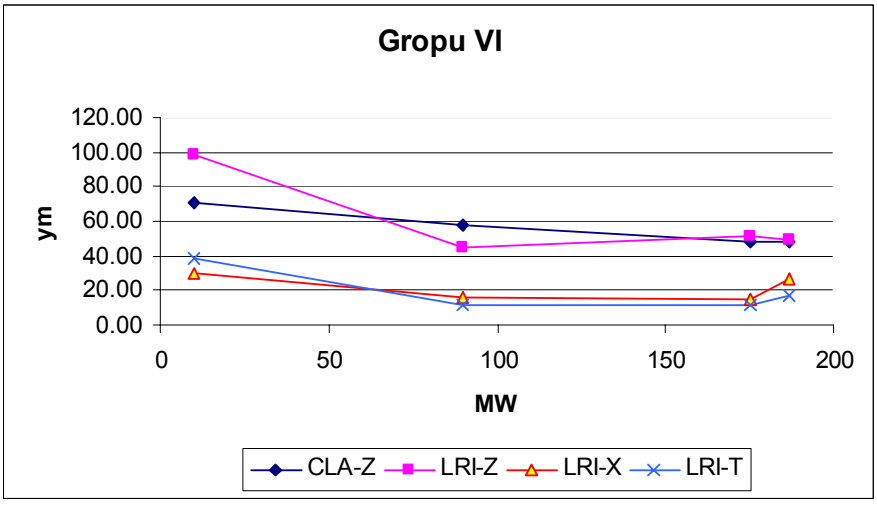

fig. 6

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