



**Consulting Report
 Noisy Transformer Problem Investigation
 OPM Office Building
 1000 Shellfish Drive, Somewhere Valley, CA**

Introduction

A 225KVA distribution transformer located on the 5th floor of 1000 Shellfish Drive is very noisy resulting in tenant complaints. PowerCET Corporation was requested to inspect and measure the electrical load on the associated transformer in an attempt to determine the cause of the excessive noise.

Methodology

A Dranetz-BMI Power Platform Model PP1 was installed on the output of the transformer to determine the characteristics of the load. The monitoring period lasted approximately 45 Minutes

Key Findings

1. The transformer is very noisy but not over heating. The quality of supply graphs on the following page indicates normal voltage levels with harmonic distortion (THD) levels at acceptable levels.
2. The voltage harmonics range from 3% to 4% with Phase A the highest—which is consistent with the phase loading as phase A has more connected load.
3. The current harmonics range from 25% to 35% THD, which is not excessive and should not normally pose a problem. Figure 1 below shows the time plot for both voltage (VTHD) and current (ITHD) for the brief monitoring period.

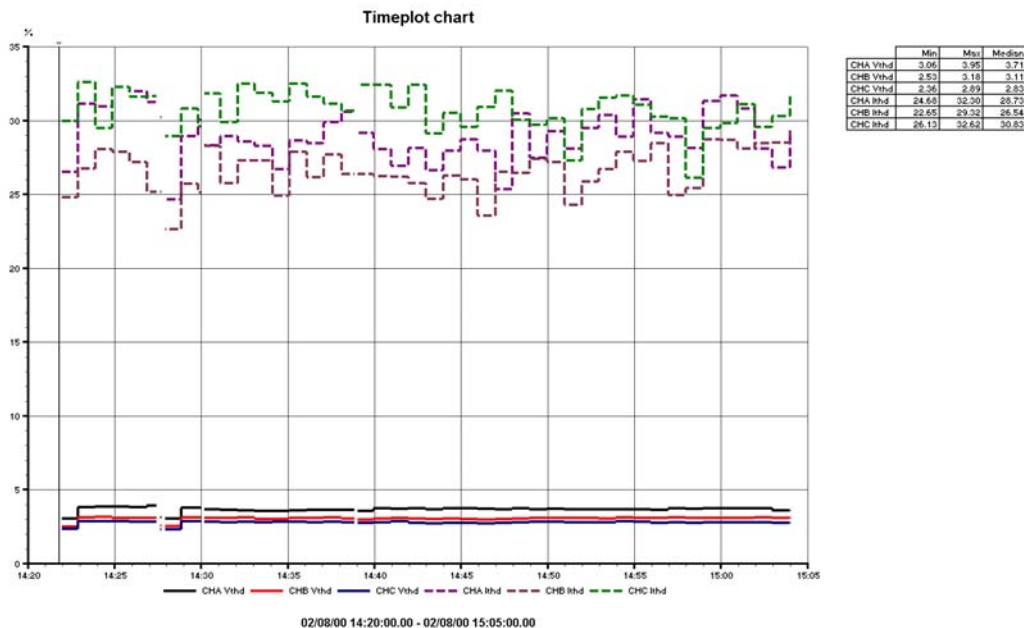
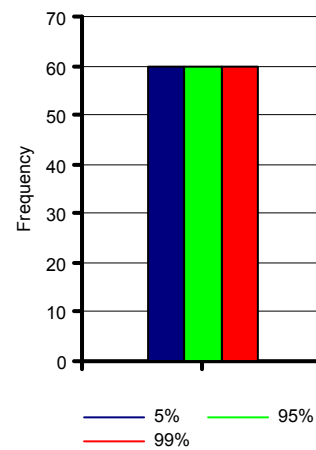
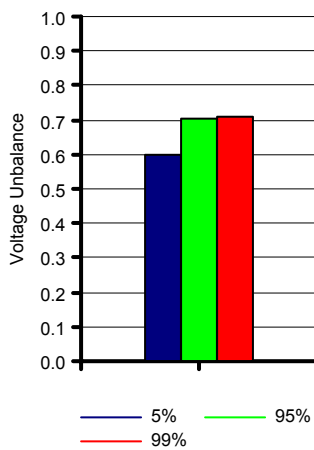
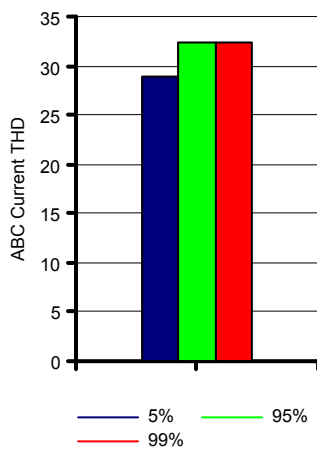
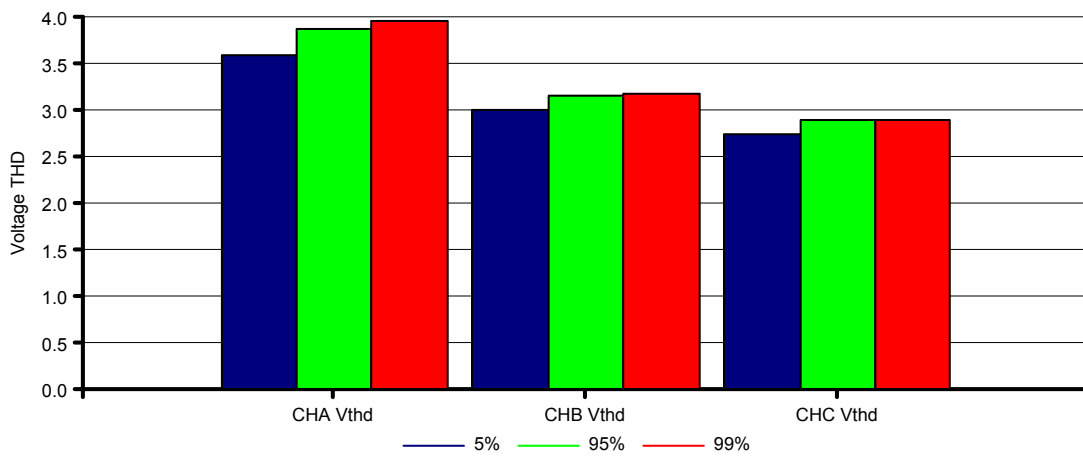
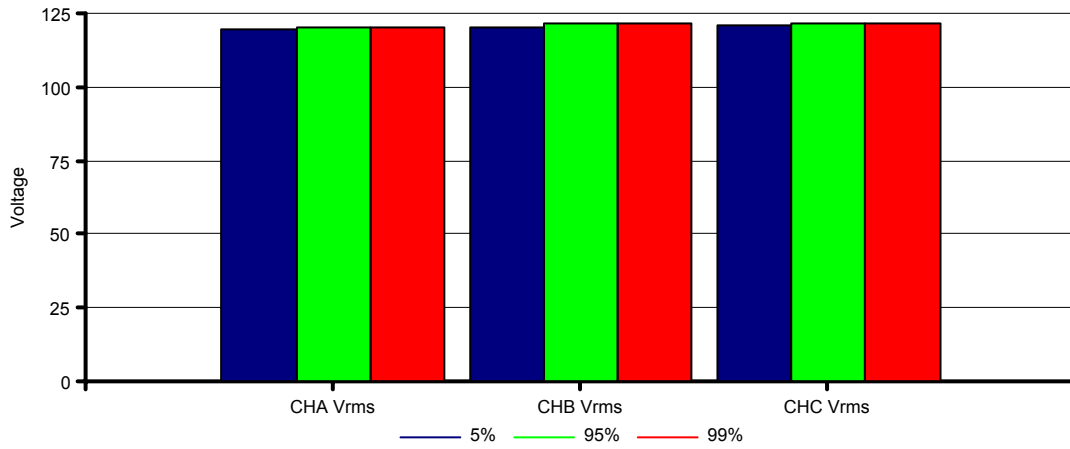


Figure 1 - Voltage & Current Harmonic Time Plots.

QUALITY OF SUPPLY SUMMARY GRAPHS



MIN/MAX/MEDIAN SUMMARY REPORT

	Channel A	Channel B
Min V	119.4 on 02/08/00 at 14:21:53	120.5 on 02/08/00 at 14:21:53
Max V	120.6 on 02/08/00 at 14:26:20	121.6 on 02/08/00 at 14:30:06
Med V	119.9	120.9

	Channel C
Min V	120.7 on 02/08/00 at 14:21:53
Max V	121.7 on 02/08/00 at 14:32:30
Med V	121.1

	Channel A	Channel B
Min I	206.2 on 02/08/00 at 14:36:04	178.0 on 02/08/00 at 14:37:29
Max I	268.6 on 02/08/00 at 14:35:02	260.8 on 02/08/00 at 14:35:02
Med I	221.5	195.3

	Channel C
Min I	155.7 on 02/08/00 at 14:37:29
Max I	234.1 on 02/08/00 at 14:35:02
Med I	163.7

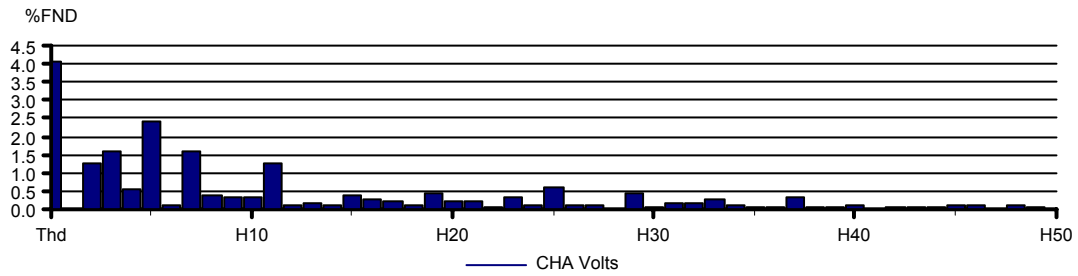
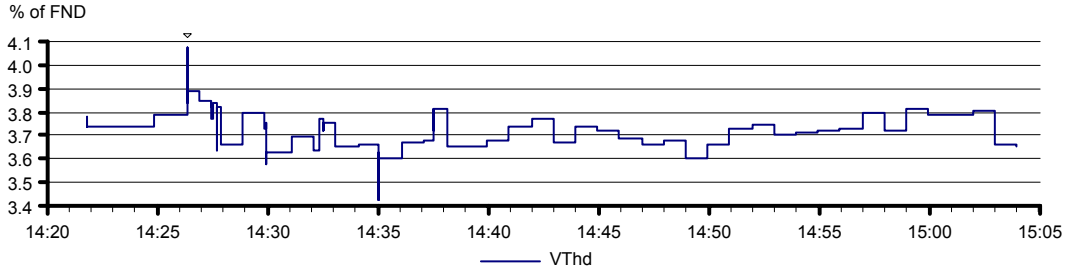
	Frequency
Min Hz	60.0 on 02/08/00 at 14:21:56
Max Hz	60.0 on 02/08/00 at 14:37:29
Med Hz	60.0

MIN/MAX/MEDIAN POWER REPORT

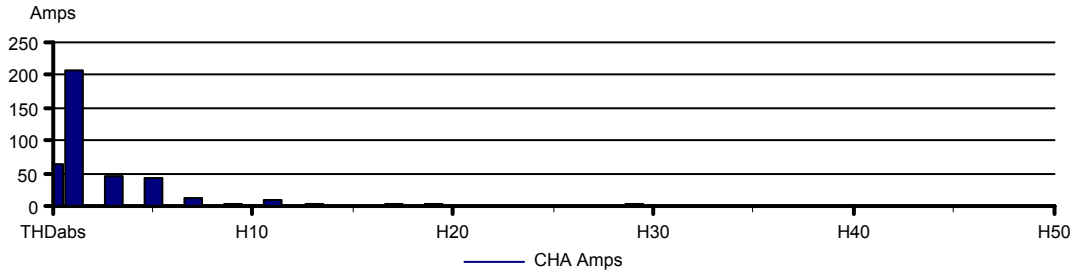
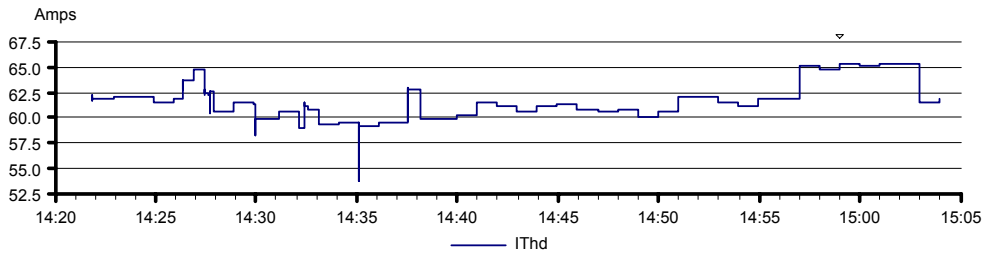
	A	B	C	ABC	
Min kW	22.6	20.1	17.0	60.3	on 02/08/00 at 14:55:56
Max kW	27.0	24.8	20.3	69.9	on 02/08/00 at 14:35:04
Med kW	24.4	22.0	18.0	63.7	
Min kVA	24.8	21.9	18.9	66.1	on 02/08/00 at 14:55:56
Max kVA	28.8	26.4	22.1	75.6	on 02/08/00 at 14:27:49
Med kVA	26.5	23.7	19.8	69.6	
Min kVAR	9.7	8.4	7.9	26.2	on 02/08/00 at 14:21:53
Max kVAR	11.3	9.9	9.1	29.9	on 02/08/00 at 14:27:49
Med kVAR	10.3	8.7	8.4	27.4	
Min PF	0.909	0.918	0.896	0.913	on 02/08/00 at 14:47:56
Max PF	0.939	0.941	0.926	0.929	on 02/08/00 at 14:39:56
Med PF	0.919	0.928	0.906	0.920	
Cumulative Energy	17.43	15.78	13.09	46.29 (kWh)	

HARMONIC SUMMARY

PHASE A - HARMONIC TIME PLOTS FROM 02/08/00 14:21:46 TO 02/08/00 15:03:57



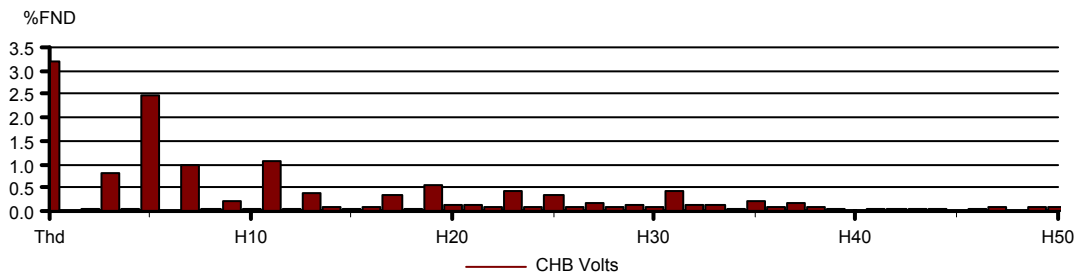
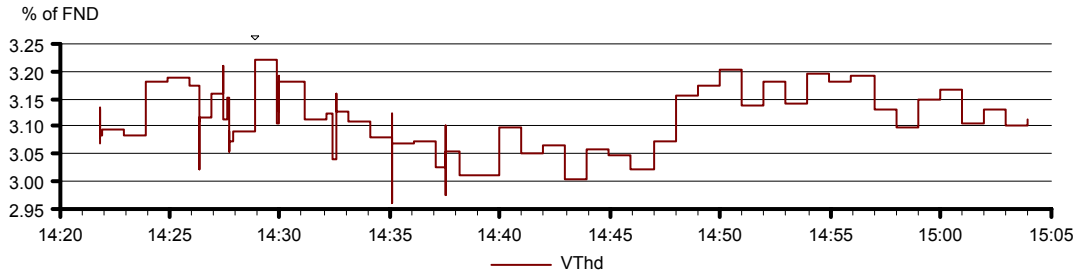
Total RMS: 120.62 Volts
 Fundamental RMS: 120.50 Volts
 Total Harmonic Distortion (H02-H50): 4.08 %FND
 Even contribution(H02-H50): 1.56 %FND
 Odd contribution(H03-H49): 3.76 %FND



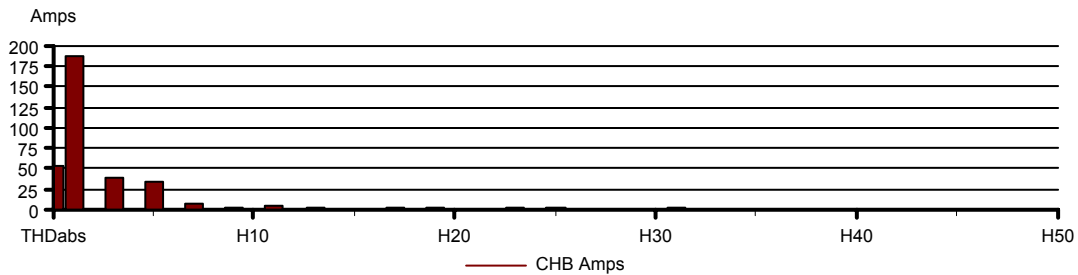
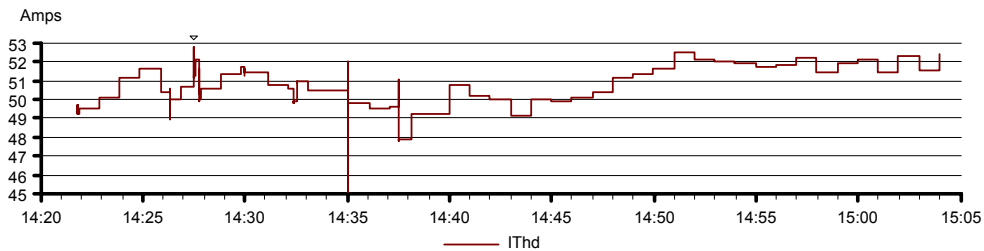
Total RMS: 217.47 Amps
 Fundamental RMS: 207.38 Amps
 Total Harmonic Distortion (H02-H50): 65.32 Amps
 Even contribution(H02-H50): 1.95 Amps
 Odd contribution(H03-H49): 65.29 Amps

HARMONIC SUMMARY

PHASE B - HARMONIC TIME PLOTS FROM 02/08/00 14:21:46 TO 02/08/00 15:03:57



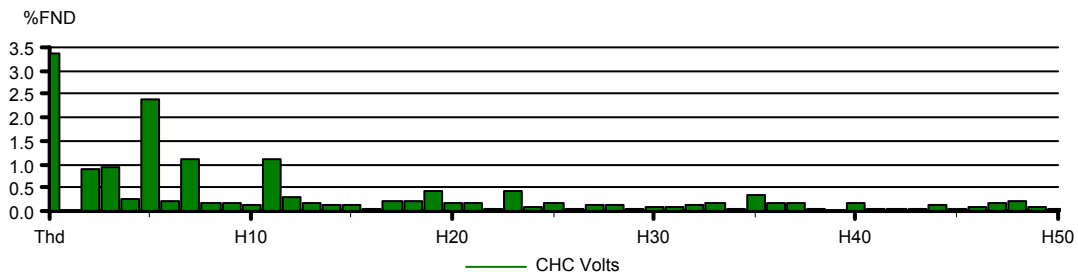
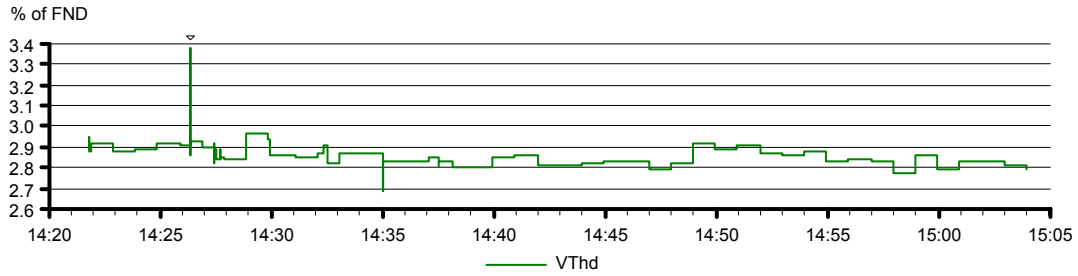
Total RMS: 121.34 Volts
 Fundamental RMS: 121.26 Volts
 Total Harmonic Distortion (H02-H50): 3.22 %FND
 Even contribution(H02-H50): 0.34 %FND
 Odd contribution(H03-H49): 3.20 %FND



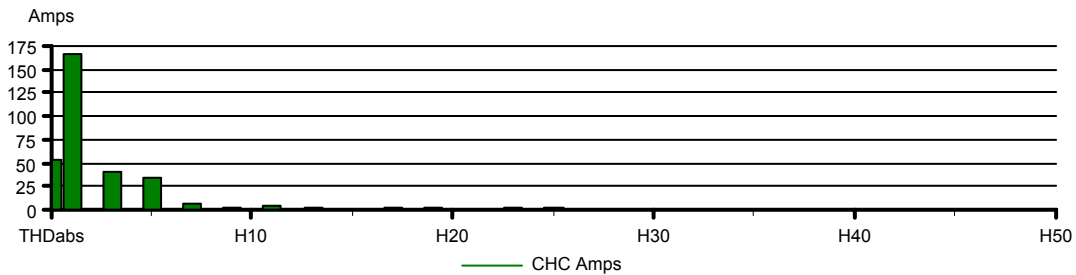
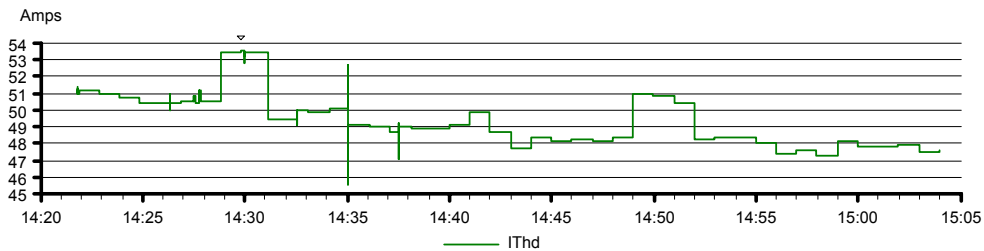
Total RMS: 195.00 Amps
 Fundamental RMS: 187.70 Amps
 Total Harmonic Distortion (H02-H50): 52.82 Amps
 Even contribution(H02-H50): 1.94 Amps
 Odd contribution(H03-H49): 52.78 Amps

HARMONIC SUMMARY

PHASE C - HARMONIC TIME PLOTS FROM 02/08/00 14:21:46 TO 02/08/00 15:03:57



Total RMS: 121.18 Volts
 Fundamental RMS: 121.11 Volts
 Total Harmonic Distortion (H02-H50): 3.38 %FND
 Even contribution(H02-H50): 1.17 %FND
 Odd contribution(H03-H49): 3.17 %FND



Total RMS: 173.98 Amps
 Fundamental RMS: 165.48 Amps
 Total Harmonic Distortion (H02-H50): 53.60 Amps
 Even contribution(H02-H50): 1.58 Amps
 Odd contribution(H03-H49): 53.58 Amps

Summary & Recommendations

A combination of factors probably account for the excessive noise associated with the transformer installation on the 5th floor. There are harmonics present from the single-phase connected computer loads but there is no indication—high voltage THD or excessive heat—that the transformer is unable to satisfactorily supply these loads.

Transformers of this size are basically handmade and this results in slightly different characteristics for each transformer. This particular unit may be noisier than the average.

This is an unusually large (oversized) transformer for the application and the light loading combined with the harmonics is causing the excessive noise. All transformers will hum and sometimes, depending on construction, the presents of harmonics will increase the audible noise.

The 800A breaker serving the 225KVA transformer does not fit the breaker panel and it was necessary to “modify” the sheet metal and leave some cabling exposed in order to install the breaker. It is doubtful that this installation meets local electrical codes. It appears that the transformer was added by a previous tenant and without the benefit of proper sizing (engineering) and inspection.

The present loading on the transformer is approximately 30% of its rated capacity, 225KVA. If, in fact, this represent the actual connected load then a 112.5KVA K-Factor rated transformer would be capable of servicing the area. There is a 208V/208-120V isolation transformer connected to the secondary of the 225KVA transformer apparently serving a computer room—this transformer could be changed out for a 480V/208-120V transformer which would further decrease the connected transformer load.

RECOMMENDATION: Retain a qualified engineering firm to review the installation and develop appropriate specifications and plans to correct installations electrical code issues.

RECOMMENDATION: Review the feasibility of (1) replacing the 225KVA transformer with one sized for the application or (2) investigate adding additional load to the transformer in an effort to decrease the audible nose.

Prepared by:

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