ABOUT US

Allan Smith Engineering Pvt. Ltd. is a reputed name in Rotary Kiln Industries for providing reliable engineering solutions. We offer's specialized maintenance services for Kiln Alignment ***(Hot and Cold),*** diagnostic maintenance, and assistance *(with surgical precision)* in repairs on rotary Kiln. We are driven by excellence and aim's to emerge as a principal name in service provider industry. Our mission is to set new bench marks in industry through our high quality services, well-designed and customized solutions. Our company is renowned for its expertise in troubleshooting typical and recurring problems thus ensuring complete and reliable operations.

In order to provide high quality and best services, at par with international standard, we are being supported by **"EUROKILN"**, an organization based in Europe. The European office also act as knowledge centre and engage in developing new instruments, procedure to provide better service to clients. Our engineering services are designed keeping the current industry trends and developments in mind, enables us to fetch results. We have earned trust of our clients, globally, through our ethical business policies and professional attitude.

We are located in city of Mumbai, Maharashtra **Allan Smith Engineering** came into being in 2009 and incorporated in 2011. **Mr. Laxmi Narayan**, owner of the company has been presented with the National Award (India) for Innovations applied to plant maintenance, by Govt. of India.

Our Specialty

Our core competency lies in designing effective engineering solutions. We focus on troubleshooting and rectification of recurring problems observed in the machine, thus ensure reliable machine operation. We are well-versed with all make of the machines to offer customised and reliable services.

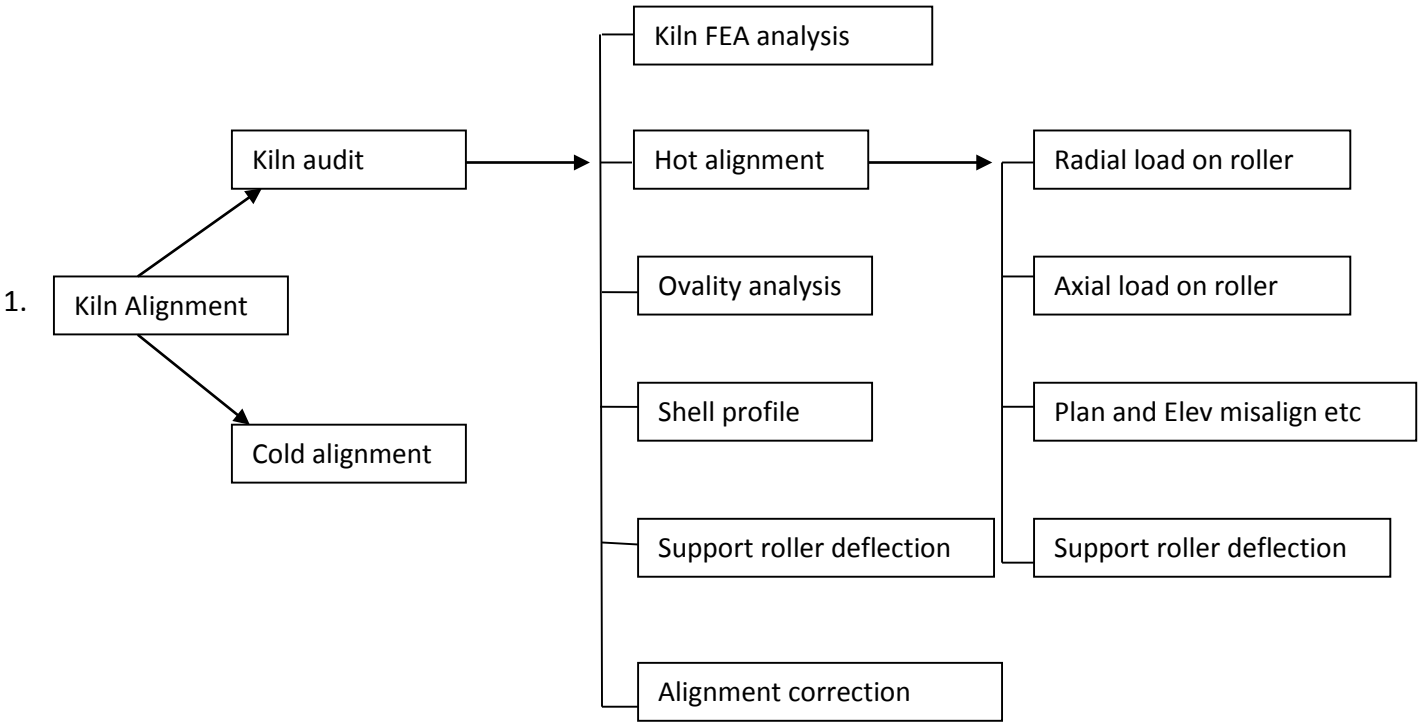
Team

We believe, our competent and resourceful team is the asset of our organization. Our team comprises of qualified and experienced mechanical engineers, supervisors, technicians and quality management personnel to mention a few. The team is working cohesively and single minded, dedicated towards the customer satisfaction.

Customer Satisfaction

Customer Satisfaction is a major yardstick with which we evaluate our company's performance and growth *(instead of INR turnover)*. We take every effort to exceed expectations of our clients. We designs and plan our services after considering the requirements and specifications put forward by the clients. Our Services:

OUR SERVICES



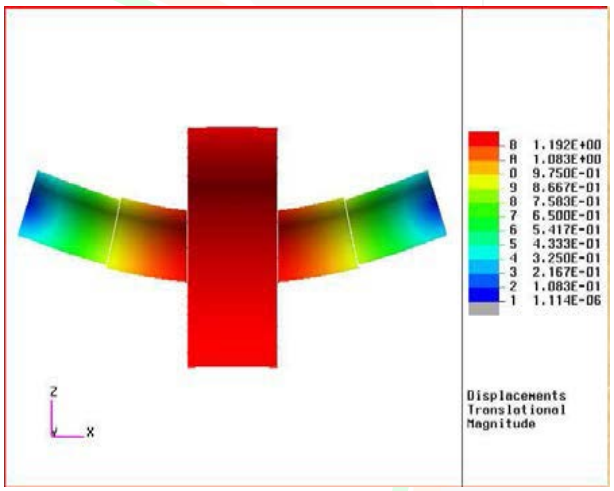
2. Kiln Erection → Shell / tyre / roller / bearing / gear replacement / erection

3. Diagnostic Maintenance → Root cause of recurring mechanical problem on kiln and components

4. Kiln and Component Design Review → Design review and designing of kiln and components for upgraded capacity.

F.E.A Analysis ***(Kiln and Components)***:

Now a day's Finite Element Analysis is being used to analyze failure analysis. FEA finds extensive application of FEA is in aerospace, automotive industry as well. In FEA, exact virtual model of machine element has been tested under practical conditions. Depending upon the test results, machine element can modify for its best performance in practice. We use FEA to carry out design review of kiln and components under normal operation. The Review and corrections ensures reliable and dependable operation.



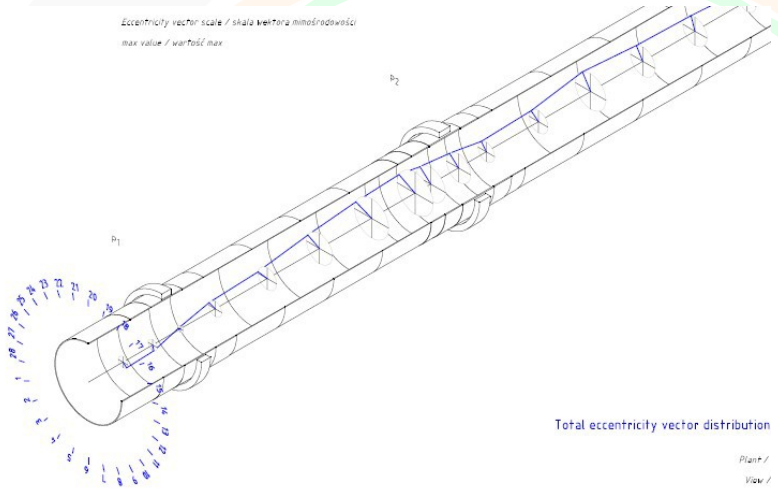
Recently we had carried out F.E.A. analysis to establish root cause of cement kiln support roller shaft shearing.

Typical bending stress and bending moment diagram drawn for KILN audit.

SHELL PROFILE MEASUREMENT

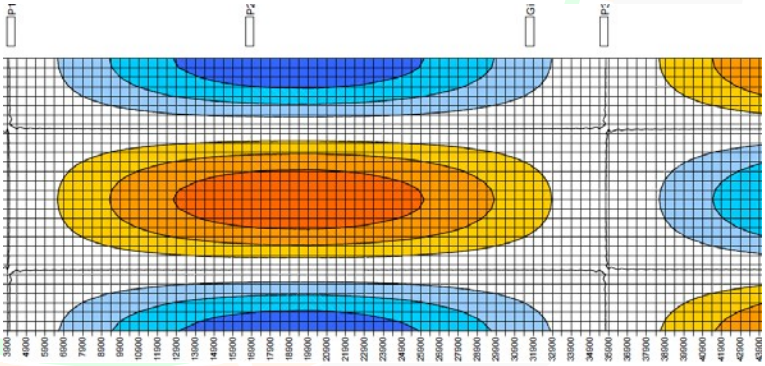
Kiln Shell Analysis:

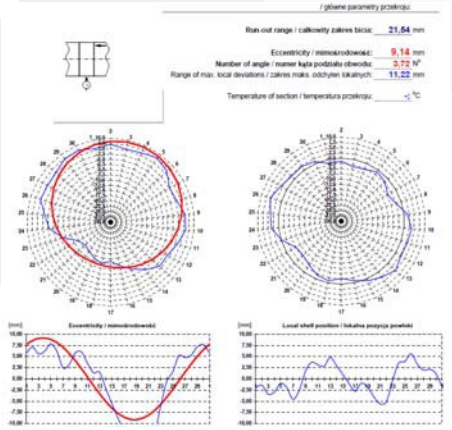
Kiln shell bend predominantly affect kiln operation, mechanically and usually result in high variation of current drawn by the main motor. The bent also influence in bearing temperatures, tyre roller contact, girth gear pinion contact etc.



Determination of Kiln Shell Profile concluded upon the measurement using laser in complete shell length @ 2-3 meter span. And, conclusion drawn of shape of the kiln shell includes bent, hidden bent, dog leg situation in the shell. The data analyzed and presents as polar diagram for eccentricity and local deformations.

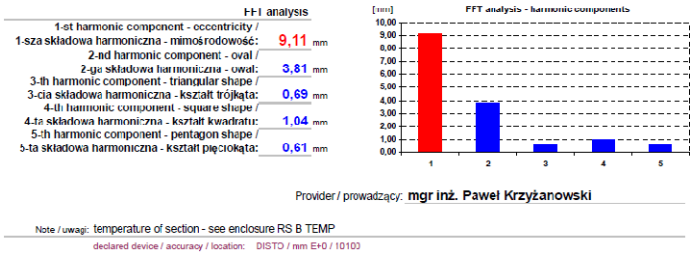
Additionally, we take reference of roller shaft deflection to conclude hidden cranks of the shell at support roller position. Also, we reverse calculate the shell bent causing shaft deflection and consider this in the real final shell axis shape.





Polar and liner graph of the shell drawn using laser data collected at a position

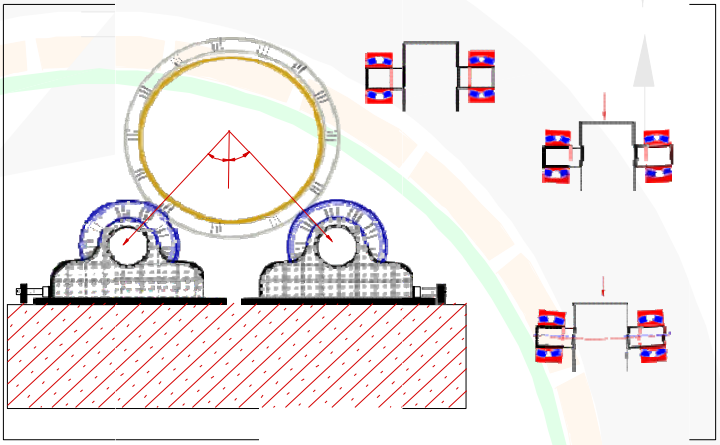
FFT analysis carried out of the above collected data.

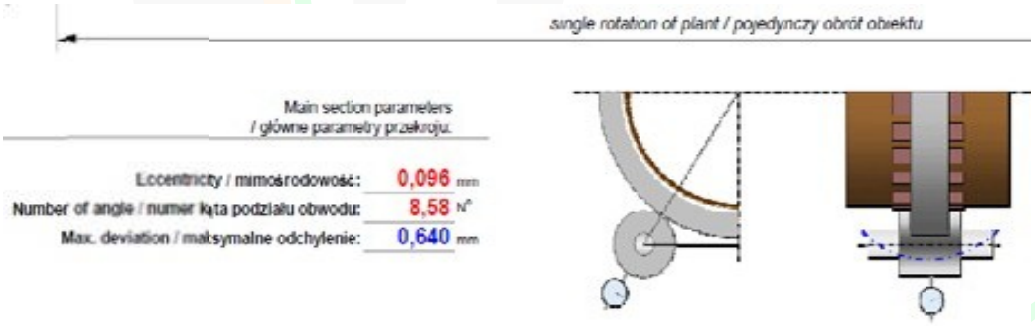


SUPPORT ROLLER DEFLECTION

Support roller deflection

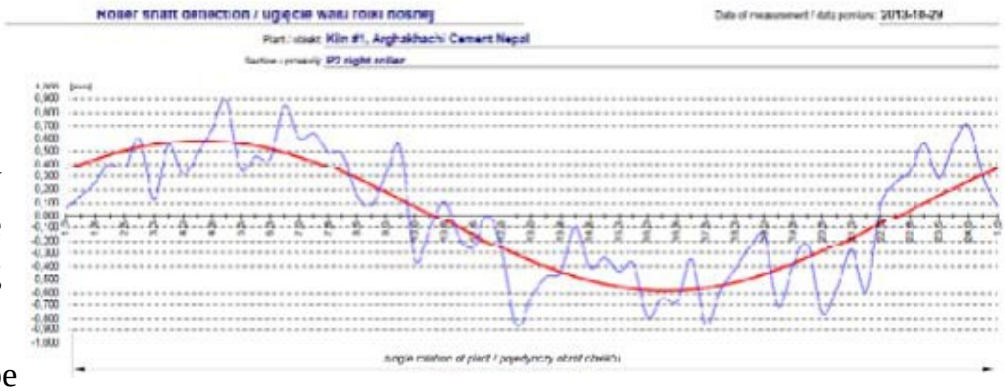
We carry out supp ort roller deflection measurement, a dynamic deflection during normal Kiln operation. Data recorded for complete rotation of kiln using high precision digital dial gauge of accuracy 0.001mm. The deflection indicate “hidden bend in kiln shell”, support roller shaft strength under operation load, etc.





Kiln shell runout/ eccentricity and hidden crank induce cyclical shaft deflection and leads to incipient of fatigue crack in the shaft.

Static deflection of the shaft will be higher but this we can’t measure; we can measure only variation in the deflection during operation. The static deflection can only be measured during shutdown.



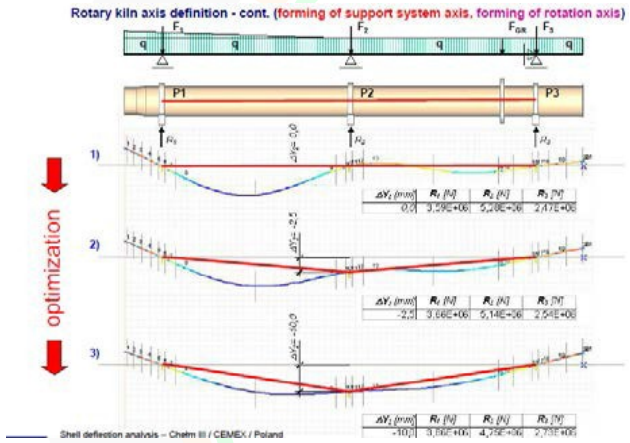
The value of dynamic deflection of support rollers is determined in reference to designed support roller dimensions. The data then compare to the measured value to conclude existence of any discrepancy.

HOT KILN ALIGNMENT

Hot Kiln Alignment *(Optimization of kiln axis)*:

Kiln alignment is undertaken to ensure parallelism of center axis of kiln and all the support rollers. Measurements are carried out on kiln and support rollers to locate the existing axis. Depending upon analyzed result, correction can be taken up to ensure parallelism in plan and elevation view.

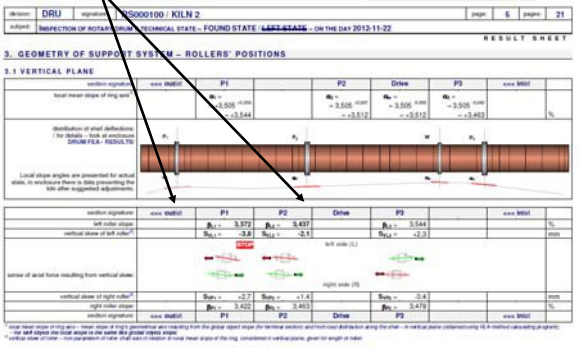
Kiln misalignment influences on load distribution on the rollers. Possibility of load variation exists because of some or other reason like one roller has higher diameter than another Roller, rollers with different elevation difference etc. Optimization of kiln load on the rollers helps to reduces differential loading between rollers at same pier.



Problem like hot bearings, overturning of bearings, excessive wear on support rollers, and excessive wear on thrust rollers can be eliminated. Proper kiln alignment ensures proper load sharing on the support rollers.

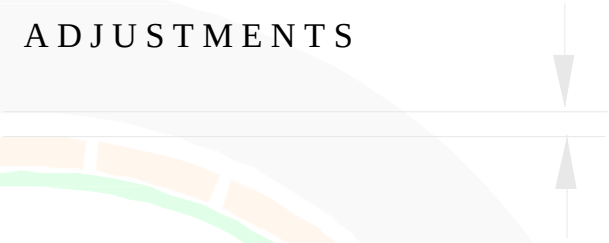
Added features:

- As a standard procedure, we are carrying out FEA analysis to check the kiln stiffness. The stiffness helps to conclude the kiln is “stiff” or “flexible”.
- We evaluate local slopes of each tire *(as shown below) - USP*



- We optimize loading on the piers, depends upon stresses in the shell. Unique accuracy of our measurements is related to the possibility of access the support roller shaft end during operation.
- Our precision of the measurement is upto fraction of millimeter. What we can see during rollers adjustment when moving the roller of 0’1 or 0’2 mm we are shifting for thrust direction

HOT KILN ADJUSTMENTS



Hot Kiln Adjustments:

We will be supervising the Hot Kiln Adjustments for the kiln alignment and skew adjustments immediately after light up. We will ensure normal kiln floatation, *If possible*. Kiln will be moving uphill with a gauge pressure *(on hydraulic thrust roller)* of around 60 bars *(or as recommended by OEM)* and return to its position at downhill when applied hydraulic pressure is reduced.

MECHANICAL BALANCING OF KILN

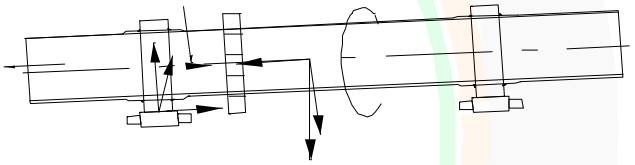
Mechanical balancing of kiln:

We had an expertise to measure precisely support skewing of support roller rollers axial thrust in elevation as well in plain view. The measurement is concluded in “mm” and “ton” and accordingly the correction carried out to optimize the axial loading on the support roller. Kiln excessive travel may consequence in:

- Damaging thrust roller/ thrust face of thrust tire.
- Partly damaging kiln end seals because of excessive axial load on faceplates.
- Result in hot bearings / damaging of bearings of support rollers.
- Excessive wear and tear on the support roller and tires surfaces.

Benefits

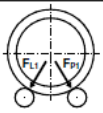
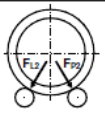
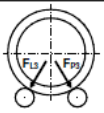
- Optimum balancing of kiln axial load may help to reduce / eliminate the above-mentioned problem/s.



division:	DRU	signature:	RS000100 / KILN 2	page:	7	pages:	21
subject:	INSPECTION OF ROTARY DRUM'S TECHNICAL STATE – FOUND STATE / ~~LEFT STATE~~ – ON THE DAY 2012-11-22						

RESULT SHEET

4. FORCES OF ROLLERS' AXIAL REACTIONS

section signature:	<<< outlet	P1	P2	Drive	P3		<<< inlet	
mean load between single roller and ring:								
		F_{L1} = 63,6	F_{L2} = 204,9		F_{L3} = 137,5			t
		F_{P1} = 96,6	F_{P2} = 152,0		F_{P3} = 183,4			t
axial reaction of left roller[1]:		$R_{A\,L1}$ = -0,8	$R_{A\,L2}$ = +9,7		$R_{A\,L3}$ = +9,6			t
directions of axial reactions coming from horizontal roller skews:			left side (L) STOP		STOP			
			right side (R)					
axial reaction of right roller[1]:		$R_{A\,P1}$ = -3,8	$R_{A\,P2}$ = -10,3		$R_{A\,P3}$ = +9,6			t
section signature:	<<< outlet	P1	P2	Drive	P3		<<< inlet	
sum of axial reactions on single support:		R_{A1} = -4,6	R_{A2} = -0,6		R_{A3} = +19,2			t
sum of axial reactions on object:				R_A = +14,0				t
axial component of object's total load[2]:				Q_A = +25,2				t

[1] axial reaction of roller – force coming from roller total skew, depending on load between ring and roller, calculating for friction factor μ=0,05 and for factor of elasticity deformation in the contact place between ring and roller e=0,0013; it is a force with which roller presses against ring in axial direction;

[2] axial component of object's total load – product of object's total load and percentage object's slope;

Further:

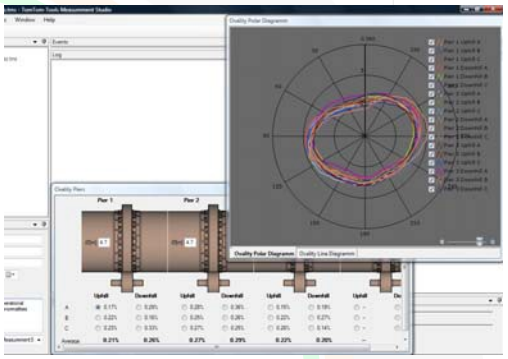
We can also support with repair technology *(developed by eurokiln and implemented successfully on rotary drum),* preparation for the shell straightening by cutting and resetting, replacement / alignment of girth gear and tires, chair pad replacement, chairpad shimming for reduction of kiln shell stresses *(tyre migration)* and adjustment kiln support roller for alignment correction.

KILN SHELL OVALITY

Kiln shell ovality is an important parameter to assess kiln health and the monitoring become mandatory upon recurring refractory problem. Ovality, is defined as difference of shell diameter in horizontal and vertical axis. The difference arises because of flexing in kiln shell during operation, thermal, material loading, etc attributed for the difference.

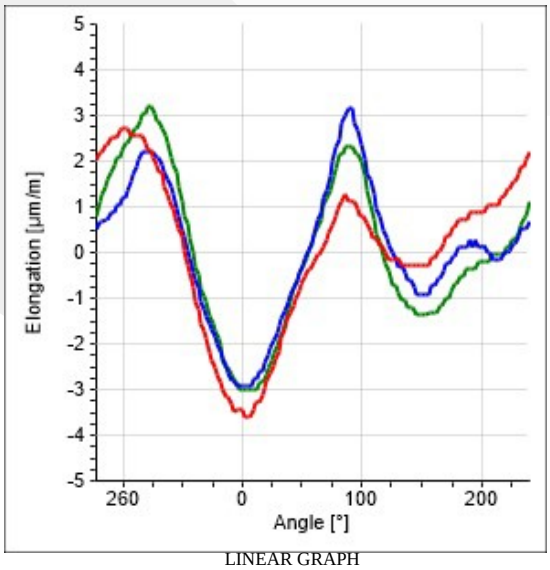
The shell flexing is governed by following factors:

1. beam strength of tyre
2. kiln shell thickness
3. kiln shell and tyre temperatures
4. kiln shell misalignment
5. air gap between tyre ID & chairpad OD
6. thermal and material loading
7. high run-out of kiln shell close to support stations, etc

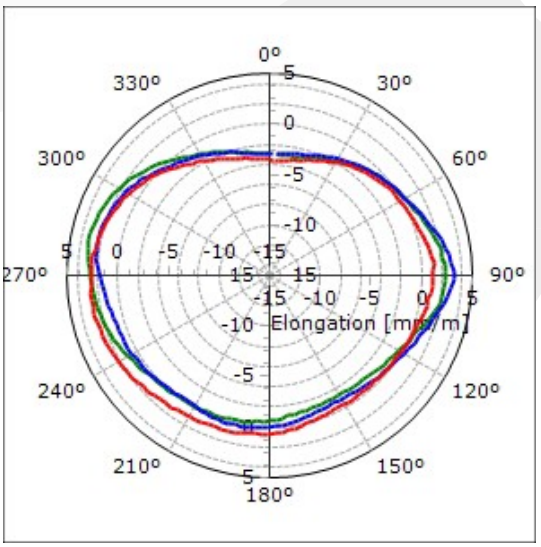


Variation in any of above factors influence shell ovality and has a detrimental effect upon the exceedance. Higher ovality has influence over refractory failure under / close by tyre section, undue stress on kiln shell and tyre section. If higher stresses are allowed for extended period, premature failure of refractory / mechanical element may results.

The measurement (services) is being carried out using high resolution beam, by directly mounting the sensor on shell during normal operation. The sensor measure and record the shell flexing using strain gauge ***(instead of dial gauge)***, during operation for the analysis. Manual / transfer error is eliminated by continuously transfer of collected data from the sensor directly to data logger ***(laptop)*** during the operation using blue tooth data transfer technology.
The graph generates represent behavior of a point on kiln shell during rotation. Typical graph appended below.



LINEAR GRAPH



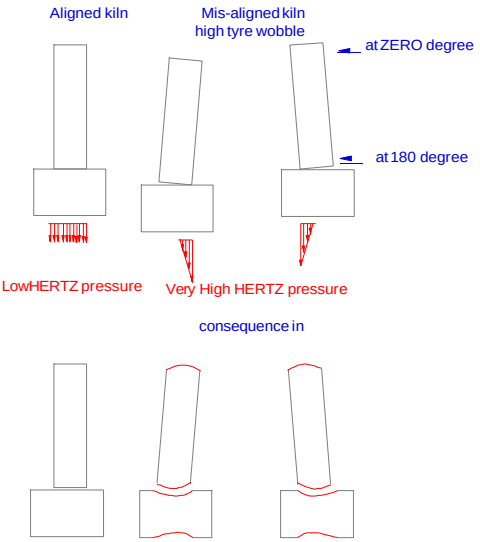
POLAR GRAPH

KILN TYRE GRINDING

Usually, question being asked for need of grinding of tyres and reasons attributed for change in shape of tyre raceways.

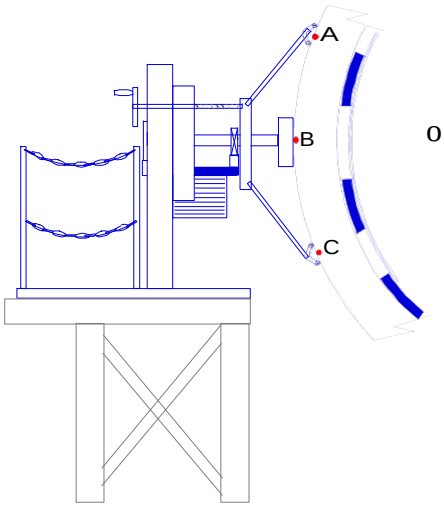
Due to abnormalities in kiln operating conditions, like:

1. High shell runout
2. High tyre wobble
3. Misalignment in kiln axis
4. Improper support roller axis, etc



Tyre wobble also called as tyre axial runout or tyre throw and usually consequence of installation error, kiln shell bend thermal or mechanical.

Tyre wobble leads to reduced contact between tyre and support roller in part of kiln revolution. The reduced contact result in higher hertz pressure on roller surface and has its own consequence and causes accelerated wear on rolling surface and adversely affects kiln axial balancing as well. From the above figure, it is obvious the wear is convex on tyre and concave on support roller. The wear begins series of problems like hot bearings, failure of tyre retainers, accelerated wear of raceways etc. Once wear pattern established, accelerated wear can be expected in order to adjust kiln axial movement by adjustment of the worn out support rollers.



Obvious solution for the above anomaly is to restore square tyre and roller raceways.

- Supports rollers are expected to operate about an axis and the resurfacing is relatively easy.

However, the resurfacing for the tyre is not easy because of wobbling in lateral and axial direction. And, tyre was removed from position and bored in vertical boring machines and reinstalled. As the methodology is not economical, an innovative approach is required beyond normal machining methods and **tyre grinding machine is developed for the resurfacing.**

Tire resurfacing technique

- ✓ Utilizes CUP grinding stone
- ✓ Methodology adopted is more or less similar to center less grinding machine
- ✓ Senses highs and lows on tyre surface
- ✓ Ensures uniform grinding stone pressure on tyre surface

Essential Technical Reservations:

1. Raceways processing by grinding does not eliminate eventual cracks and/or other discontinuities existing in the material. They may be disclosed during machining or during further exploitation of the regenerated element. In some cases, disclosure of hidden defect may occur much faster than in case when the machining would not be executed at all. Therefore it is very important to execute non-destructive testing **(1)** before taking decision about grinding of any elements. Such tests are helping to take a right decision (choice) between replacement of element and its reasonable regeneration.

2. Raceways machining by grinding is reducing the thickness of the raceway section, causing in the most cases natural weakening of its strength. ASEPL recommends execution of adequate, preventive strength analysis **(2),** which would unambiguously determine the decrease in mechanical strength parameters of element after grinding in reference to the same parameters before grinding or in reference to the object of nominal dimensions.

3. Regardless of the fact of execution of strength analysis and regardless of the obtained results, ASEPL always tries to limit the risk of unnecessary decrease of element's strength. Due to that some surface defects like local deep chipping, pitting and other material loses, local shape deformations, burrs on the raceway's edges – causing local raceways diameter's reduction, are eliminated only in limited way or are left without processing. Such approach states optimal choice between the ideal shape on the whole surface and as low as possible reduction of the diameter and shortening of the resurfacing time – decrease of the cost. Such approach is not stating about the improper execution of the service and all such decisions are consulted each time with the ordered and/or object's owner.

4. The fact of intensive wear and tear of rings' and/or support rollers' and/or thrust rollers' raceways is most likely the result of irregularities' occurrence in the range of support system's geometry, including wrongly established support rollers' skews and/or wrong positions of the remaining elements. Grinding of raceways removes only effect of problem, doesn't remove the source. That's why ASEPL recommends each time to make before or during grinding inspection of support system connected with at least preliminary support rollers' adjustment **(3)** to obtain satisfying long term result. It is important also to consider that support rollers wrongly skewed introduce to support system tendency of strong pushing against thrust rollers. This tendency is revealed often just after raceways' regeneration, i.e. after removal of all irregularities which limit freedom of object's axial movement. Both, releasing of drum from such constrains as well as change of friction factor in the contact place between ring and support rollers might be the cause of excessive load of thrust rollers, and then adjustment of support rollers is the only antidote. But ASEPL staff without measurement of rollers' present positions can't determine proper values of adjustment. In result all emergency corrections of support rollers may be ineffective or implemented too late.

5. ASEPL not guaranteeing the lasting of the effect of regeneration nor proper object's operation, in case of presence of: -
   a. Wobbling of the live ring (its axial run out) resulting in alternating (inlet/outlet) appearance of gap on raceways contact line with support rollers;
   b. Wrong positions of support rollers in vertical and/or horizontal plane;
   c. Wrong position(s) of the thrust roller(s);
   d. Improper shape and/or positioning of the element cooperating with the regenerated element, especially when we do not know detailed technical state of the whole drum;
   e. Excessive permanent or cyclic loads during exploitation of the object in reference to the ones adopted in calculations / strength analysis;
   f. Defects in the material of grinded elements, especially when before grinding it was not executed any non-destructive testing and/or strength analysis;
   g. Improper conditions of object exploitation or force majeure.

   Therefore ASEPL recommends to execute appropriate study preceding the decision of resurfacing **((1), (2), (3))** or at least to conduct the initial qualification tests **(4)**.

   In each case decision about service's stoppage is consulted with the orderer and/or object's owner and requires preparation of appropriate protocol to confirm that it was taken jointly.