# 2019 CEMA ENGINEERING CONFERENCE

## CONVEYOR IDLER COMMITTEE MEETING

**La Playa Hotel, Naples, FL**

**Tuesday, June 25, 2019 – 8:30 am**

## AGENDA

1. Call to Order

2. Attendance and Introductions

3. Approval of Agenda

4. Review and approval of June 26, 2018 minutes (Attached)

5. Old Business
   a) **CEMA G idler dimensions** – Updates
   b) **High Speed Conveying** – (Subcommittee Chair: Jim Masek, PPI) – Updates
   c) **5 roll troughing idlers** – Updates
   d) **Research into localized belt indentation issues in CEMA G may prompt a minimum roll diameter** – (Dr. Robin Steven, ContiTech North America, Inc.)
   e) **CEMA standards compared to International Standards (DIN, ISO, etc.)** – (Subcommittee Chair: Andrew Hustrulid, Shaw Almex) – Updates

6. New Business
   a) **CEMA White Paper** - Volunteers needed.
      – Status of $L_{10}$ life of tapered roller bearing white paper, Keith Meyers, SKF (slides attached)

      Other ideas for white papers:
      – Predictive maintenance for idlers – detection to prevent failure/seizure.
      – Training force of 5-roll vs 3-roll training idlers
      – Safety guarding for return rolls
      – Best practices for changing idlers
      – Bridging the gap between CEMA standards and international standards.
      – Other ideas?
   b) **Other new business**

7. Next Meeting: June 16, 2020 at La Playa Hotel. Naples, FL

8. Adjourn

Jim Masek, Chair
Paul Schmidgall, Vice Chair

# MINUTES OF THE CEMA ENGINEERING CONFERENCE

## CONVEYOR IDLER COMMITTEE MEETING

**Tuesday, June 26, 2018**

1. Call to Order
   Committee Vice Chair Jim Masek, Precision Pulley and Idler Co. (PPI); and Acting Secretary Paul Schmidgall, Superior Industries; called the meeting to order at 9:03 am.

2. Roll call - 44 people were in attendance (attached).

3. Minutes from the June 27, 2017 were reviewed and approved.

4. Old Business
   a) **CEMA G idler dimensions.** (attached)
      - CEMA G Idler Dimensions were reviewed. A CEMA G Idler dimensional survey had been sent out, and responses were received from four companies. A sub-committee was created to condense the information.
      - The information was condensed, and it was presented at the 2017 CEMA Fall Meeting. At the fall meeting, it was pointed out that some of the values were less than those associated with the CEMA F Idlers. The CEMA G Idler Dimensions were adjusted to consider the dimensions of the CEMA F Idlers, and these were presented at the 2018 Engineering Conference. There were no objections to the dimensions as presented.
      - Phil Hannigan (CEMA) said that the CEMA G Idler Dimensions will now be sent to idler ORs for final approval prior to including them in the standard

   b) **High-Speed Conveying.**
   Sub-Committee: Jim Masek, PPI (jmasek@ppi-global.com) – chair; Tom Hubbert, Dos Santos International (thubbert@dossantosintl.com); Paul Ormsbee, Overland Conveyor Co. Inc. (ormsbee@overlandconveyor.com); Paul Schmidgall, Superior Industries (p.schmidgall@superior-ind.com); Andrew Jennings, Conveyor Dynamics, Inc. (Jennings@conveyor-dynamics.com); Robin Steven, ContiTech North America, Inc. (rsteven@contitech.us); Benjamin Brewer, Douglas Manufacturing Co., Inc. (bbrewer@douglasmanufacturing.com); Luis Estay, Bechtel Mining & Metals (lrestays@bechtel.com); Nick Mackenzie, Rulmeca Canada Limited (nmackenzie@rulmeca.com); Dr. Andrew Hustrulid, Shaw Almex Industries (andrew.hustrulid@almex.com)
      - General discussion supporting the belief that high-speed conveying is a relevant topic, and it was discussed to continue this investigation and identify what factors are important for high-speed conveying.
      - The sub-committee to continue to investigate this topic will stay intact. Jim Masek, PPI (jmasek@ppi-global.com) will continue to Chair this sub-committee.

c) **5-Roll Troughing Idlers.**
   - There was a call for new information.
   - Topic to be kept active in old business. Some manufacturers noted that there were regular requests for 5-roll troughing idlers. No motion was made to create a 5-roll idler standard. It was generally agreed to keep this item on the agenda under old business.

5. New Business
   a) **CEMA Whitepaper - Volunteers needed**.
      - Benjamin Brewer submitted a white paper.
      - A new call was made for volunteers and ideas. Although no authors volunteered at this time, the following ideas were mentioned:
        - Predictive maintenance for idlers - detection to prevent failure / seizure
        - Training force of 5-roll vs 3-roll training idlers
        - Safety guarding for return rolls
        - Best practices for changing idlers
        - Bridging the gap between CEMA standards and international standards
   b) **Research into localized belt indentation issues in CEMA G may prompt a minimum roll diameter.**
      - Discussion concerning potential belt failure issues when exposed to loads requiring CEMA G Idlers based on limited FEA. Given the current load ratings, a minimum idler roll diameter may be required if the belt can support the load.
      - Dr. Robin Steven, ContiTech North America, Inc.; volunteered to look further into this topic and submit his research to this committee at the next CEMA Engineering Conference.
   c) **CEMA standards compared to International Standards (DIN, ISO, etc.).**
      - Topic was brought up regarding confusion of CEMA standards and International standards such as DIN and ISO.
      - Discussion centered on how CEMA standards present information on the idler set while international standards provide information on the individual rolls.
      - Some expanded on this idea citing how CEMA standards do not supply details on the shaft ends of the rolls while the international standards do supply that information.
      - Some suggested that customers' confusion with this may lead them to stay away from CEMA idlers and rolls.
      - As evidence of a roll-centered point of view, some customers have been designing/requesting idlers with larger, heavier duty center rolls and smaller, lighter wing rolls to improve energy efficiency. Providing more roll information might help with international acceptance of CEMA.
      - Possible solutions to help eliminate confusion:
        - Explain the differences in the standards and that most or all CEMA member companies can manufacture rolls and shaft end details to their specification.
        - Add roll only load ratings and dimensions to the standard's appendix
      - There was interest in creating a sub-committee for this topic; Dr. Andrew Hustrulid, Shaw Almex Industries (andrew.hustrulid@almex.com) volunteered to chair this sub-committee.

Sub- Committee: Jim Masek, PPI (jmasek@ppi-global.com); Paul Schmidgall, Superior Industries (p.schmidgall@superior-ind.com)

d) **Did CEMA do a research paper derating of $L_{10}$ life of tapered roller bearing?**
   - No evidence was found of the paper.
   - Keith Meyers, SKF USA, Inc.; submitted information on the $L_{10mr}$ life of bearings that considers bearing lubrication, how well the bearing is isolated from contaminants, the angular deflection, and the internal clearance of the bearing. He volunteered to submit a whitepaper or proposal on how to calculate $L_{10}$ life for bearings as related to ISO standard

e) **Question about CEMA giving guidance on normal running bearing temperature and maximum bearing temperature**
   - What is normal and what is the maximum temperature? CEMA received this question and passed it onto the Idler Committee. This led to further discussion on grease and sealing of idler bearings. The bearing temperature can depend on many factors. Some mentioned using FLIR and other methods to look for units that were noticeably hotter than the rest of the population.
   - This led to discussion about determining a baseline temperature for the idlers on a given conveyor and looking for units that are some percentage hotter than the other units around them. It was mentioned that continuously monitoring bearing temps came up as a white paper topic in the unit section, where a high limit would give a warning and a high-high limit would shut down a conveyor.
   - Keith Myers, SKF USA, Inc.; added that vibration is the best early indicator of bearing failure in most pulley applications, while ultrasonic noise detection is the best method for applications like idlers.
   - It was suggested that this topic should be passed on to the Emerging Technologies Committee.

6. Election of a Vice Chair
   Paul Schmidgall, Superior Industries; was nominated and elected as Vice Chair.

7. The next scheduled meeting will be on June 25, 2019 at La Playa Hotel, Naples, FL.

8. Meeting was adjourned at 10:01 am.

Respectfully submitted,
Jim Masek, Vice Chair
Paul Schmidgall, Acting Secretary

# Rolling bearing rating life in 2019

Keith Meyers, P.E.  SKF

The CEMA Standard 7, Chapter 5 for idler roller uses the ISO Basic rating, $L_{10}$ (1962) for rating the life of rolling bearings. This is based on the bearing design, manufacture, and quality and the applied load and rotational speed. CEMA Standard 7, Chapter 8 for pulleys uses the current ISO 281-2007 rating life standards but does consider how heavily the bearing is loaded, lubricated, or the contamination level. There is a more advanced ISO/TS-16281(2008) that considered influence of bearing design and misalignment,.

Most rolling bearings, including those operating in conveyors fail from poor lubrication and contamination. Many conveyor manufacturers differentiate their products based on the bearings, lubrication and sealing they use, but don't use the ISO standard to their advantage to quantify theses features or select bearings.

Not all rolling bearings have the same capabilities or performance by design or manufacturer, same as with conveyors. But all bearing manufacturers recognize the rating life standards.

The following slide gives the evolution of the bearing rating life standards. This is followed by some slides giving examples of rating lives using the $L_{10m}$ (2007) and $L_{10mr}$ (2008) rating standards.

Should CEMA explore how we can benefit from using these modern standards in a better way?

# Rolling bearing rating life standards

| Standard - year | Symbol for rating life* | Design, manu-facturing, quality | Load | Speed | Lubrication | Contamination | Fatigue load limit | Clearance | Misalignment |
|---|---|---|---|---|---|---|---|---|---|
| R281 – 1962 (1947) | $L_{10}$ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ |
| ISO 281 - 1978 | $L_{10a}$ | ✓+ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ |
| ISO 281 - 2007 | $L_{10m}$ | ✓++ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ |
| ISO/TS 16281 - 2008 | $L_{10mr}$ | ✓++ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

$$L_{10} = \left(\frac{C}{P}\right)^p$$ ← Basic rating life (CEMA standard)

$$L_{10a} = a_{23}\left(\frac{C}{P}\right)^p$$ ← Adjusted rating life

$$L_{10m} = a_{ISO}\left(\frac{C}{P}\right)^p$$ ← Modified rating life

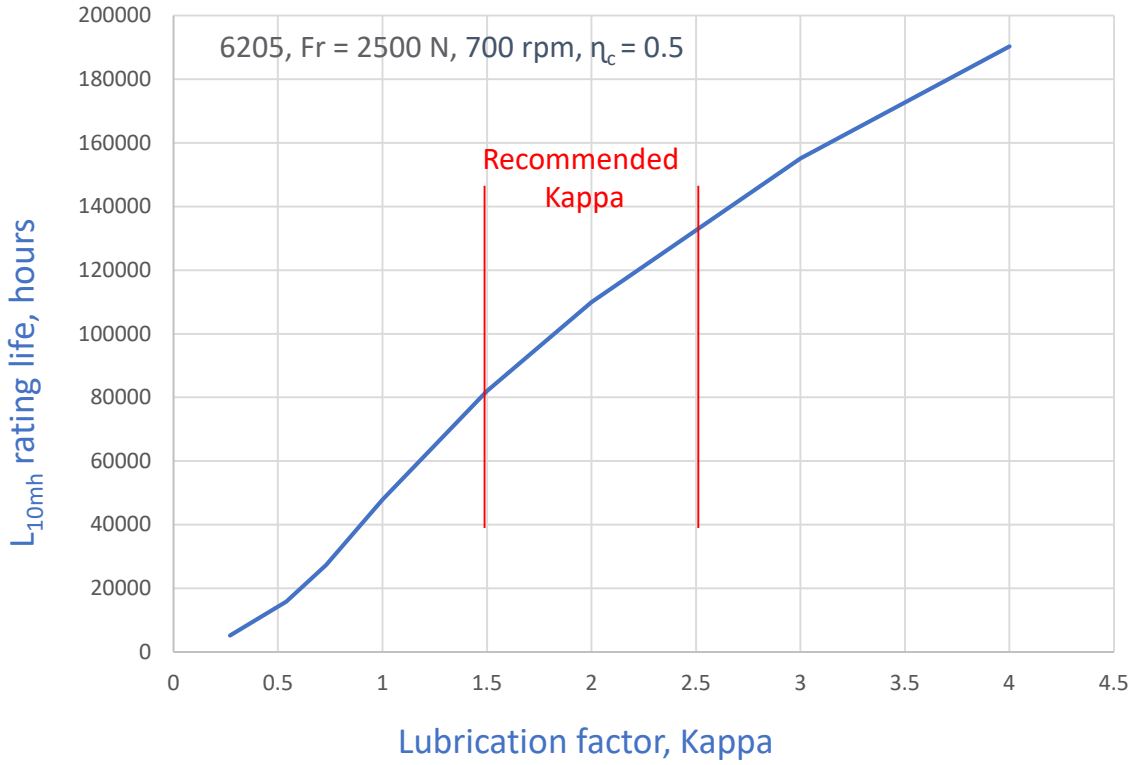
$$L_{nmr} = a_1\left\{\sum_{k=1}^{n_s}\left\{\left[a_{ISO}\left(\frac{e_C C_{ur}}{P_{ks}}, \kappa\right)\right]^{-9/8}\left[\left(\frac{q_{kci}}{q_{kei}}\right)^{-9/2} + \left(\frac{q_{kce}}{q_{kee}}\right)^{-9/2}\right]\right\}\right\}^{-8/9}$$ ← Modified reference rating life

| Rating life | Hand calculation | Computer |
|---|---|---|
| $L_{10}$ | ✓ | ✓ |
| $L_{10a}$ | ✓ | ✓ |
| $L_{10m}$ | ✓ | ✓ |
| $L_{10mr}$ | ✗ | ✓ |

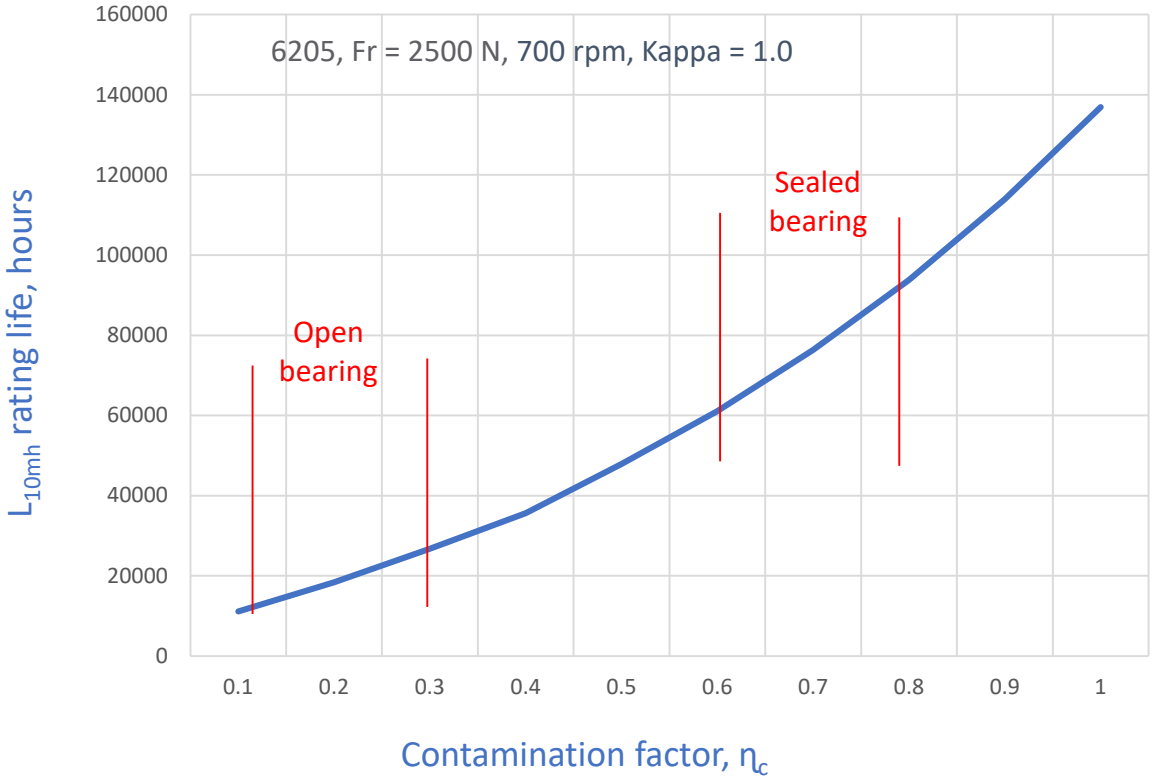
* $L_{10} = a_1 = 1$

# $L_{10m}$ - influence of lubrication and contamination

## Effect of lubrication




## Effect of contamination

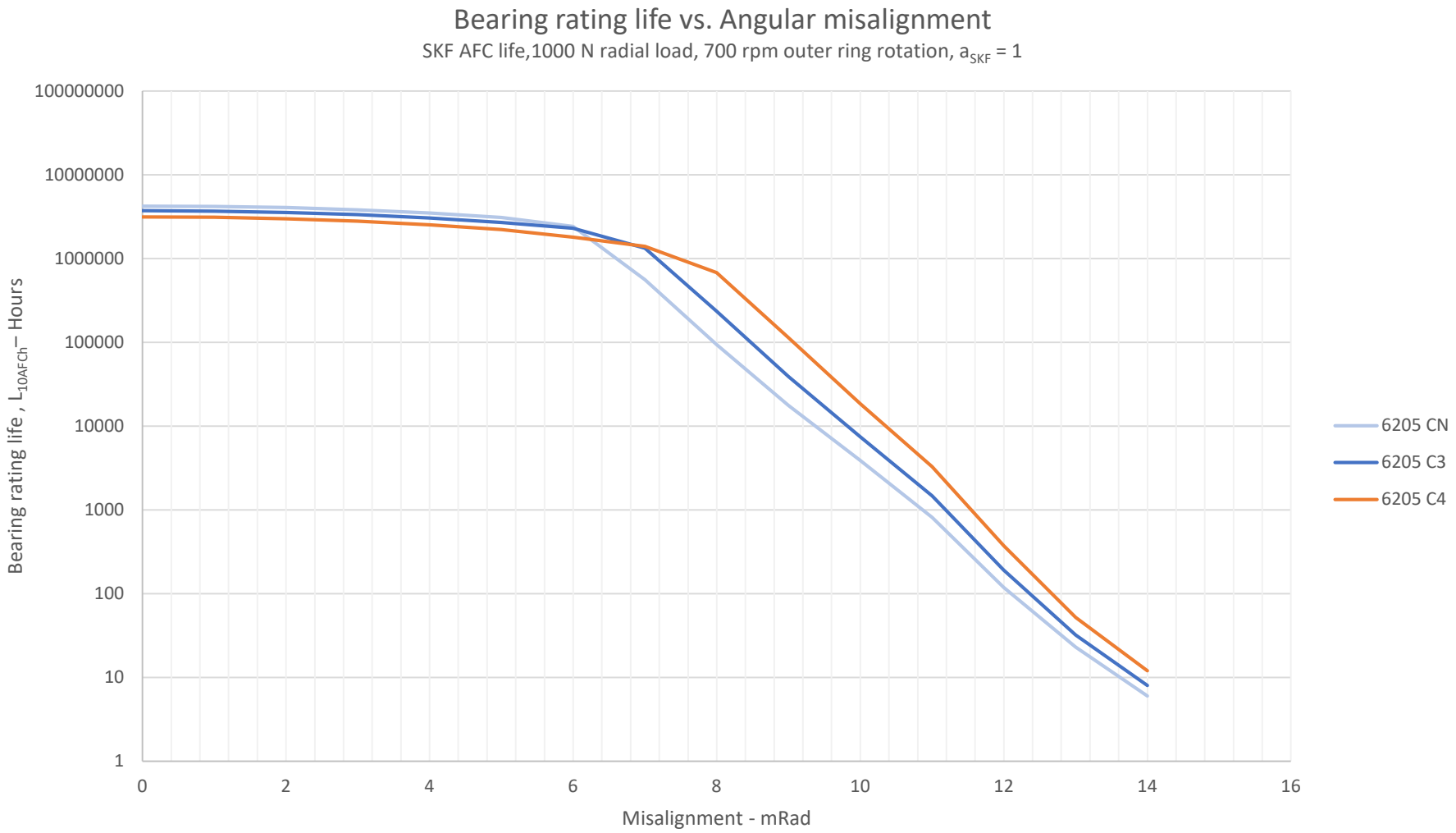



$$\kappa = \text{Viscosity ratio} = \frac{\nu}{\nu_1}$$

$\nu$ = Viscosity at operating temperature, $mm^2/s$

$\nu_1$ = Minimium required viscosity, $mm^2/s$

# $L_{10mr}$ considering bearing clearance and misalignment



# $L_{10mr}$ comparing ball and tapered bearings in misalignment