

L-42-1 Sub-Committee Meeting Minutes

Virtual Meeting – WebEx

October 12, 2022

Attendees: voting members in **bold**

R. Banas (Exxon Mobil)

K. Drlja (LZ)

M. Sangpeal (Afton/C)

D. Beck (TMC)

A. Goyal (BASF)

R. Slocum (LZ)

J. Carter (Meritor)

A. Lange (Intertek)

W. Venhoff (LZ)

M. Charron (SwRI)

C. Louis (SwRI)

A. Comfort (US Army)

T. Muransky (AAM)

L-42-1 Development

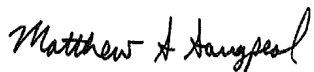
C. Louis presented on SwRI's progress on electric L-42-1 test development. Two additional tests were run: one with TMC 117 oil (High Ref) and one with TMC 113 oil (Discrimination). No changes to the stand were made since the last set of runs. The same batch of C1L446/P8AD132 axles was used. Scoring severity for both oils increased, would not be valid under current targets. Discussions were had around the level and impact of Shock I scoring on EOT scoring. Some labs see Shock I scoring with Discrimination oil, others do not. Additional details and data can be found in the attached presentation.

A decision was made to eliminate the Shock I portion of the test and repeat with both reference oils. Results will be presented at the next ASTM SP meeting in November.

New/Open Issues

Donated axles from one lab were received. Another lab will send their five donated axles soon.

Respectfully submitted,



Matt Sangpeal

L-42 Surveillance Panel Chairman

L-42-I Test Summary

SOUTHWEST RESEARCH INSTITUTE®

Caroline Mueller
10/12/2022



All Tests Summary

| Test Number | Oil Code | EOT Date | Final Pinion Rating (Adjusted) | Final Ring Rating (Adjusted) | On L-42 Target? |
|-------------|---------------------|----------|--------------------------------|------------------------------|-----------------|
| 01-0003 | TMC 117 (High Ref) | 4/22/22 | 22% | 15% | Y |
| 01-0004 | TMC 113 (Disc. Oil) | 4/25/22 | 52% | 42% | Y |
| 01-0005 | TMC 117 (High Ref) | 6/16/22 | 30% | 18% | Y |
| 01-0006 | TMC 113 (Disc. Oil) | 6/17/22 | 46% | 36% | N |
| 01-0007 | TMC 117 (High Ref) | 6/20/22 | 30% | 20% | Y |
| 01-0008 | TMC 113 (Disc. Oil) | 6/20/22 | 43% | 33% | N |
| 01-0009 | TMC 117 (High Ref) | 9/27/22 | 33% | 18% | N |
| 01-0010 | TMC 113 (Disc. Oil) | 9/28/22 | 61% | 49% | N |



Discussion

- Steady torque levels for conditioning and shocks over tests 0003-0010
 - Conditioning 4 is most variable portion of test at this point
- Reference oils perform significantly differently, but not are not discriminating as much as L-42 specification requires
- No Shock I scoring on any run, any oil. This makes achieving discrimination more difficult.
- Scoring on L-42-I test hardware is consistent with where Shock 2 scoring would be on L-42. No indication of scoring where Shock I scoring is normally seen (more central to the tooth).



Proposed Next Steps

Get Shock 1 contribution to total scoring on discrimination oil

1. Recalibrate all instrumentation (~7 mo. since last cal)
2. Increase Shock 1 severity to approximately -100 ft-lb peak coast side
3. Run on discrimination oil:
 1. Repeated sets of (5) Shock 1 cycles until approximately 20% scoring
 2. Run out shock 2 as is
 3. Rate per usual (assuming this means high % scoring and % polishing)
4. Tune down shock 2 to achieve approximately 60% total scoring for discrimination oil (not including polishing)
5. Repeat step 4 with high ref oil
 1. Tune down shock 1 and repeat if Shock 1 scoring occurs on high ref

Reminder to ship 5x current batch L-42 axles to SwRI!



REFERENCE

All Operational Data



Test Number 01-0009, TMC 117 (High Reference Oil)



Stats—Conditioning 01-0009

| Conditioning 1 | | | |
|----------------------|--------|-------------------|------|
| Input Torque [ft-lb] | | Input Speed [rpm] | |
| Target | 60 ± 5 | Target | 2363 |
| Avg | 59.6 | Avg | 2361 |
| Min | 54.4 | Min | 2357 |
| Max | 65.0 | Max | 2365 |

| Conditioning 2 | | | | | | | |
|---------------------------------|-------|---------------------------------|-------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| Target | | Target | | Target | 2363 | Target | 1562 |
| Avg | 113.3 | Avg | -58.2 | Avg | 2366 | Avg | 1581 |
| Min | 113.2 | Min | -59.0 | Min | 2365 | Min | 1580 |
| Max | 113.4 | Max | -57.7 | Max | 2367 | Max | 1582 |

| Conditioning 3 | | | |
|----------------------|--------|-------------------|------|
| Input Torque [ft-lb] | | Input Speed [rpm] | |
| Target | 70 ± 5 | Target | 3350 |
| Avg | 70.0 | Avg | 3346 |
| Min | 69.2 | Min | 3343 |
| Max | 71.6 | Max | 3349 |

| Conditioning 4 | | | | | | | |
|---------------------------------|-------|---------------------------------|-------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| Target | | Target | | Target | 3350 | Target | 2754 |
| Avg | 115.0 | Avg | -63.6 | Avg | 3353 | Avg | 2752 |
| Min | 113.6 | Min | -71.1 | Min | 3351 | Min | 2751 |
| Max | 116.0 | Max | -59.7 | Max | 3355 | Max | 2754 |



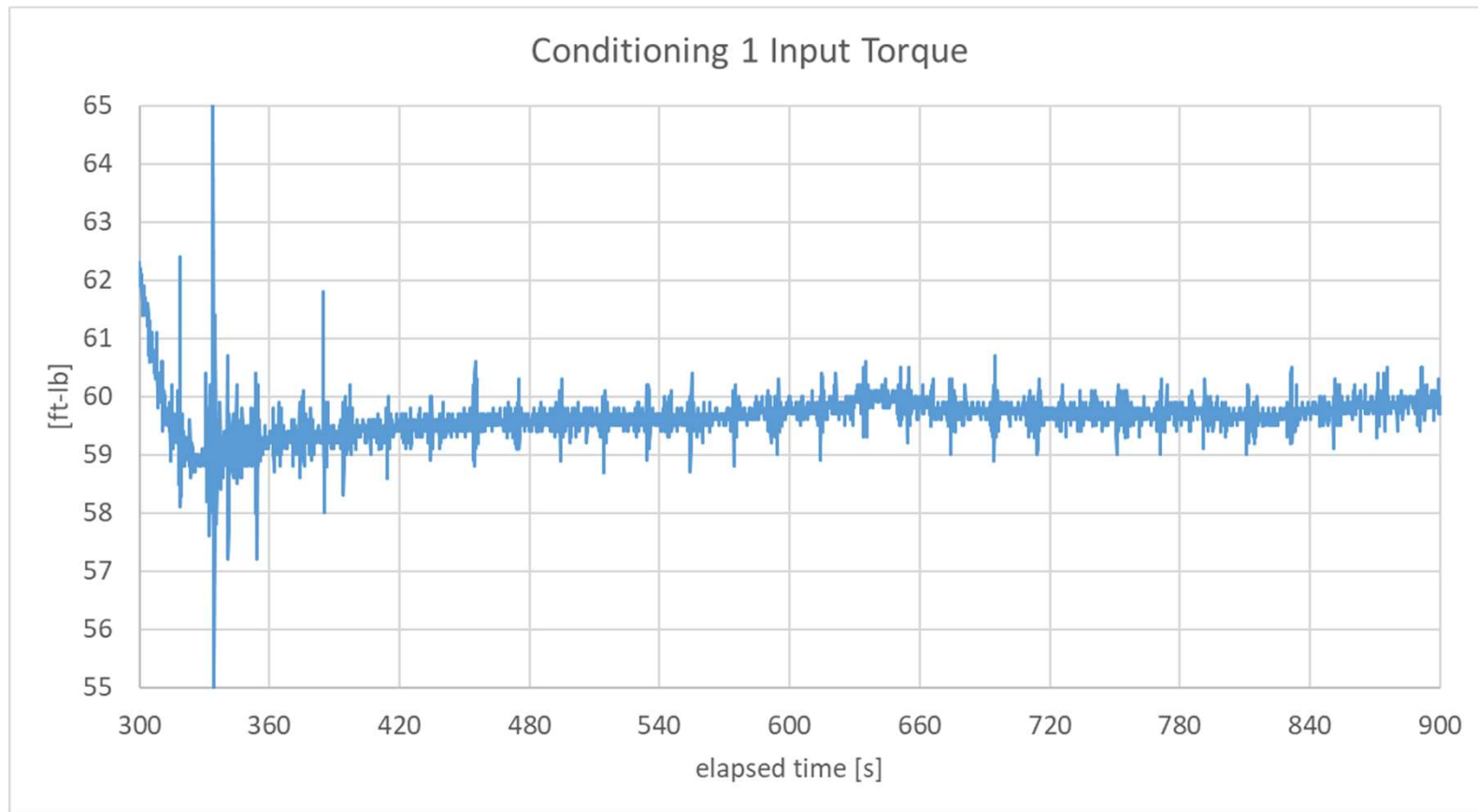
Stats—Shocks 01-0009

| Shock 1 | | | | | | | |
|---------------------------------|---------------------------------|---------------------------|---------------------------|---------------|------|---------------|------|
| Peak Input Torque Drive [ft-lb] | Peak Input Torque Coast [ft-lb] | Maximum Input Speed [rpm] | Minimum Input Speed [rpm] | | | | |
| <i>Target</i> | | <i>Target</i> | | <i>Target</i> | 4316 | <i>Target</i> | 2178 |
| Avg | 234.0 | Avg | -66.2 | Avg | 4349 | Avg | 2190 |
| Min | 232.4 | Min | -69.8 | Min | 4348 | Min | 2173 |
| Max | 236.2 | Max | -62.1 | Max | 4352 | Max | 2195 |

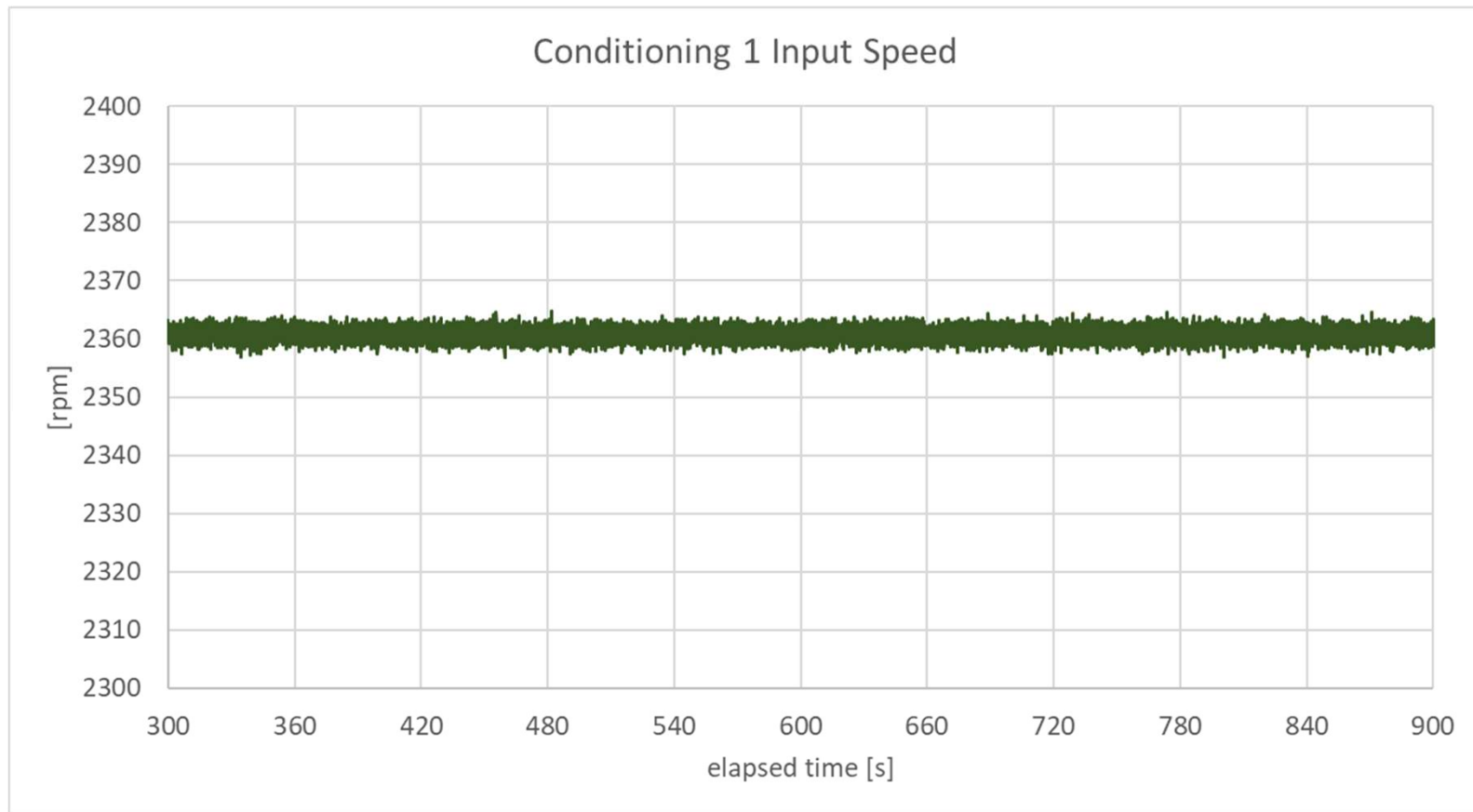
| Shock 2 | | | | | | | |
|---------------------------------|---------------------------------|---------------------------|---------------------------|---------------|------|---------------|------|
| Peak Input Torque Drive [ft-lb] | Peak Input Torque Coast [ft-lb] | Maximum Input Speed [rpm] | Minimum Input Speed [rpm] | | | | |
| <i>Target</i> | | <i>Target</i> | | <i>Target</i> | 3083 | <i>Target</i> | 2178 |
| Avg | 224.5 | Avg | -228.9 | Avg | 3075 | Avg | 2169 |
| Min | 223.0 | Min | -232.2 | Min | 3075 | Min | 2166 |
| Max | 227.2 | Max | -217.2 | Max | 3077 | Max | 2173 |



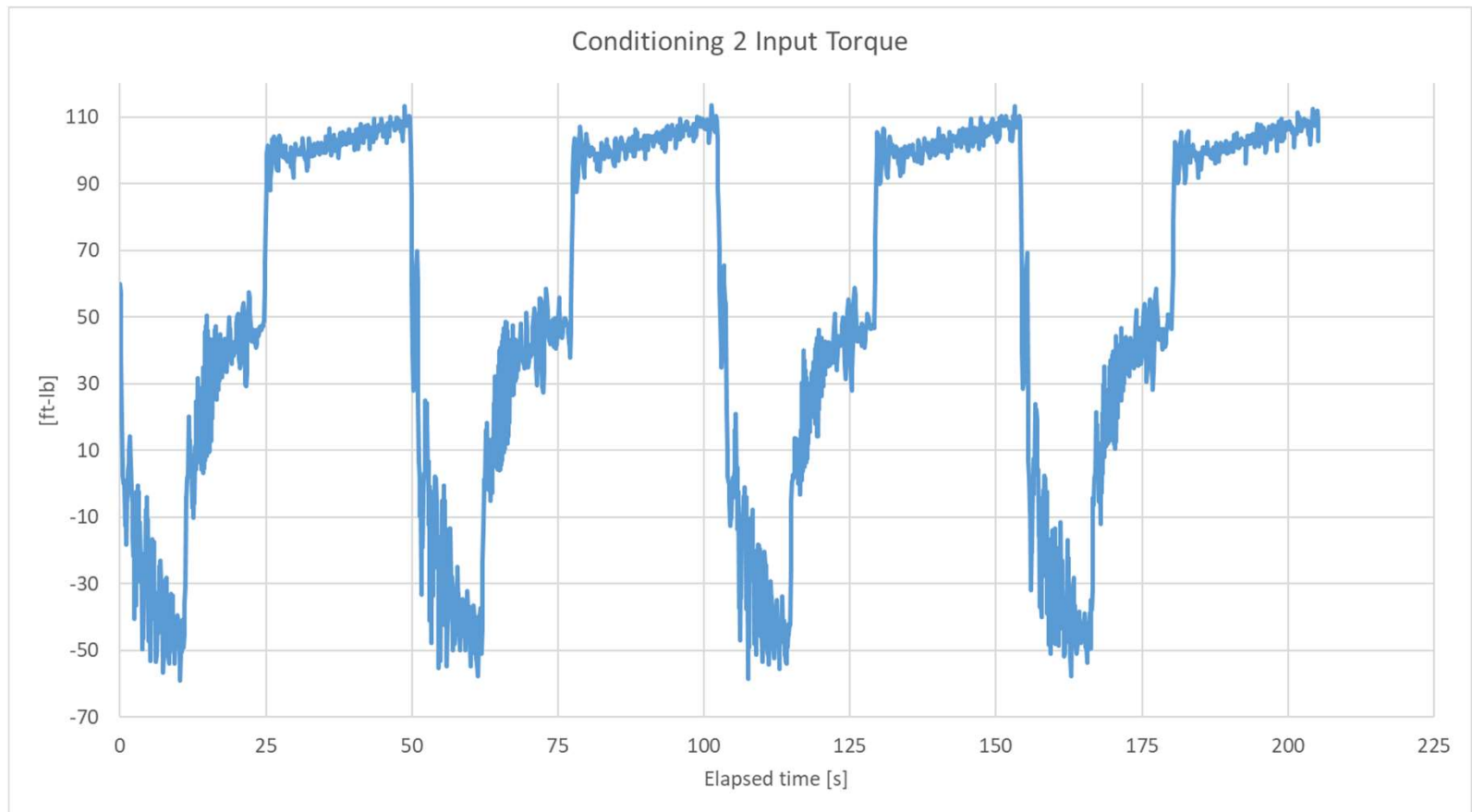
Conditioning I—0 I-0009



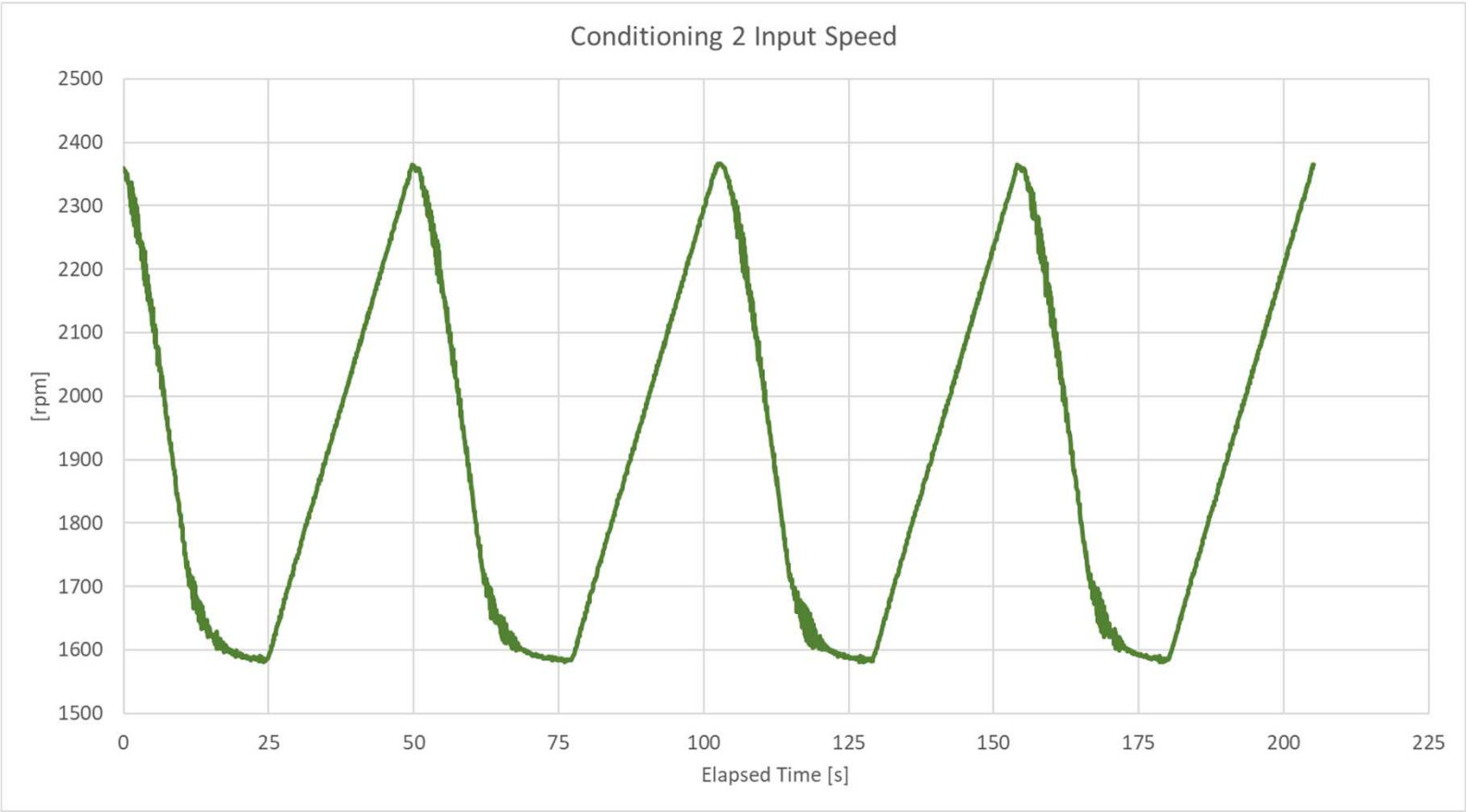
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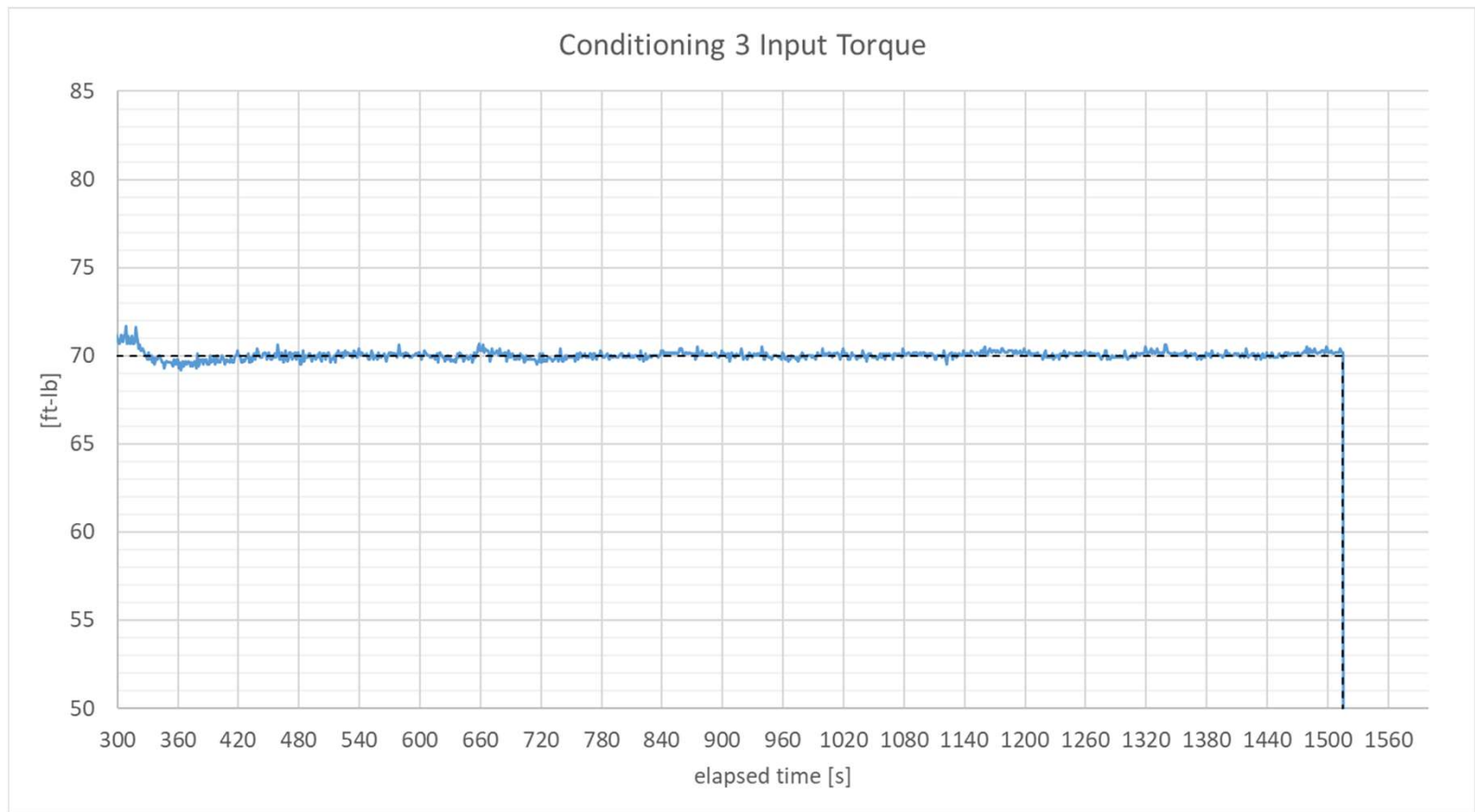
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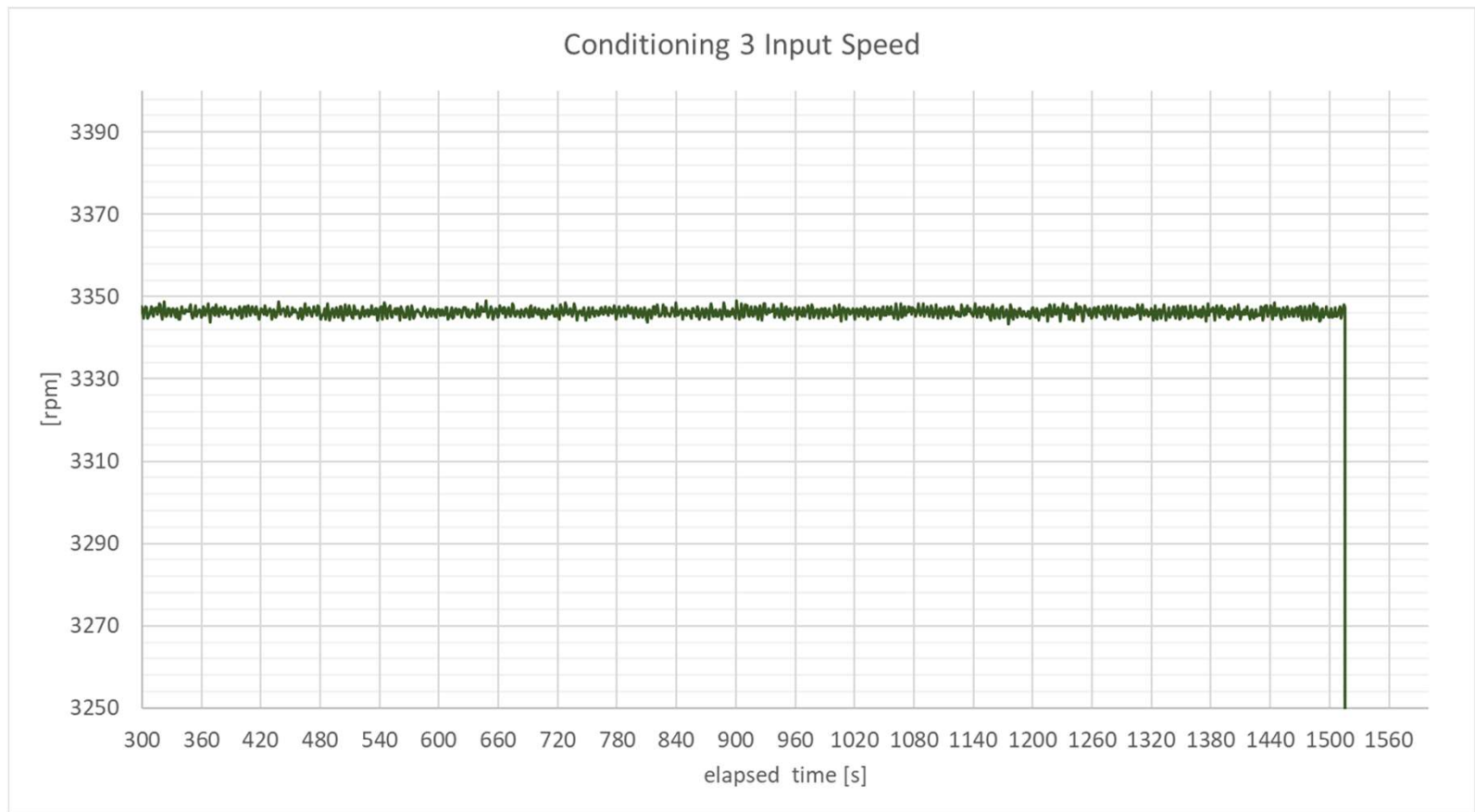
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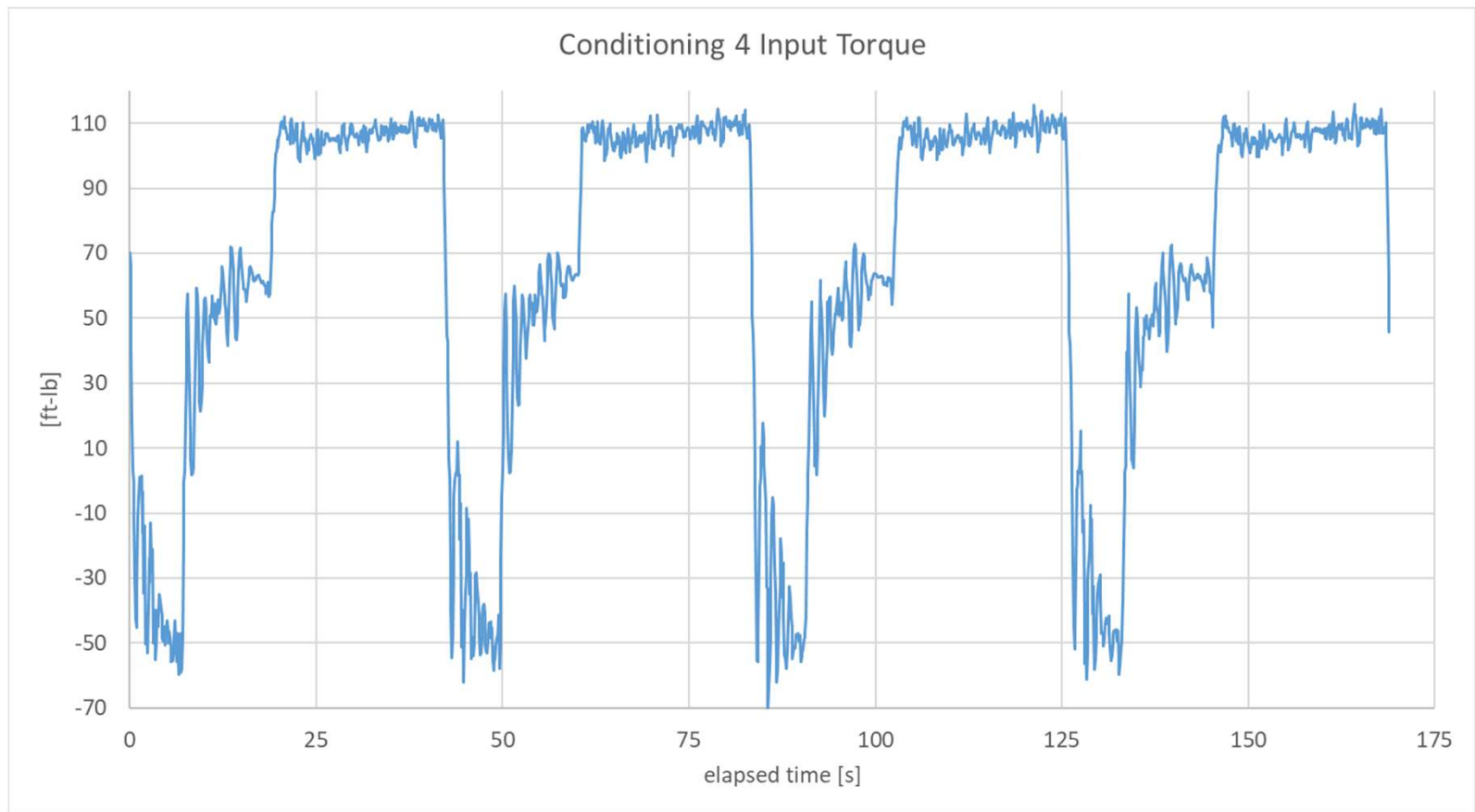
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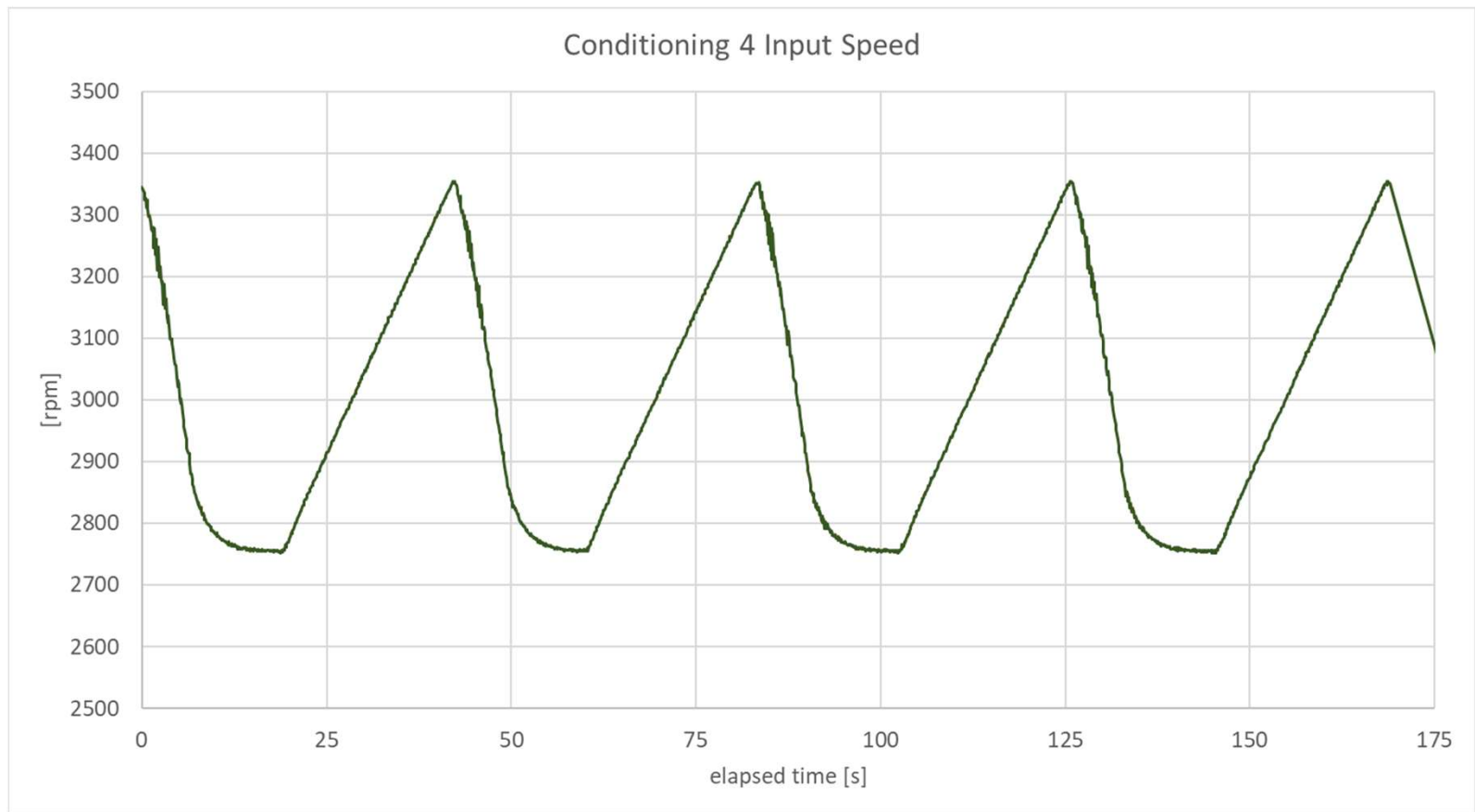
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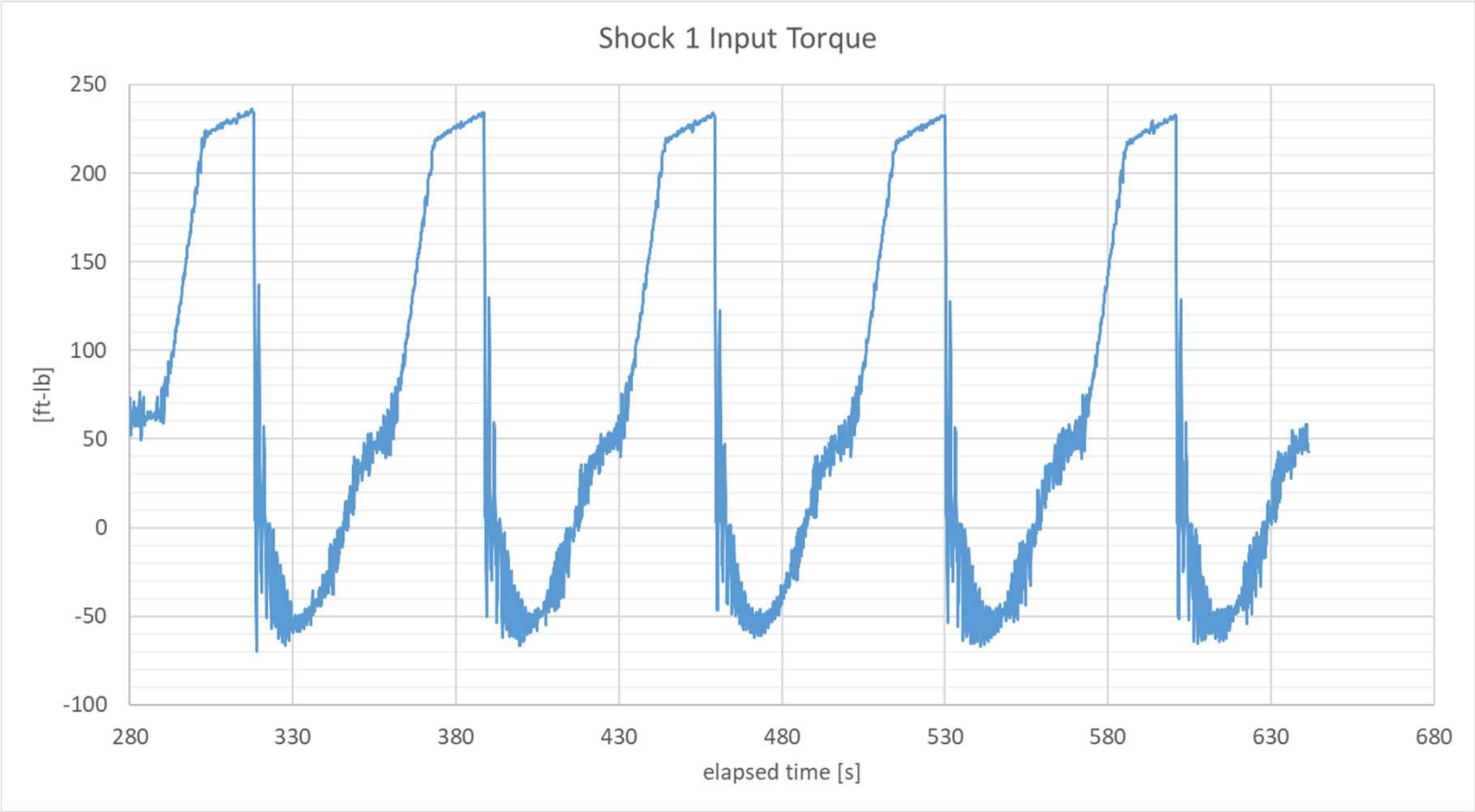
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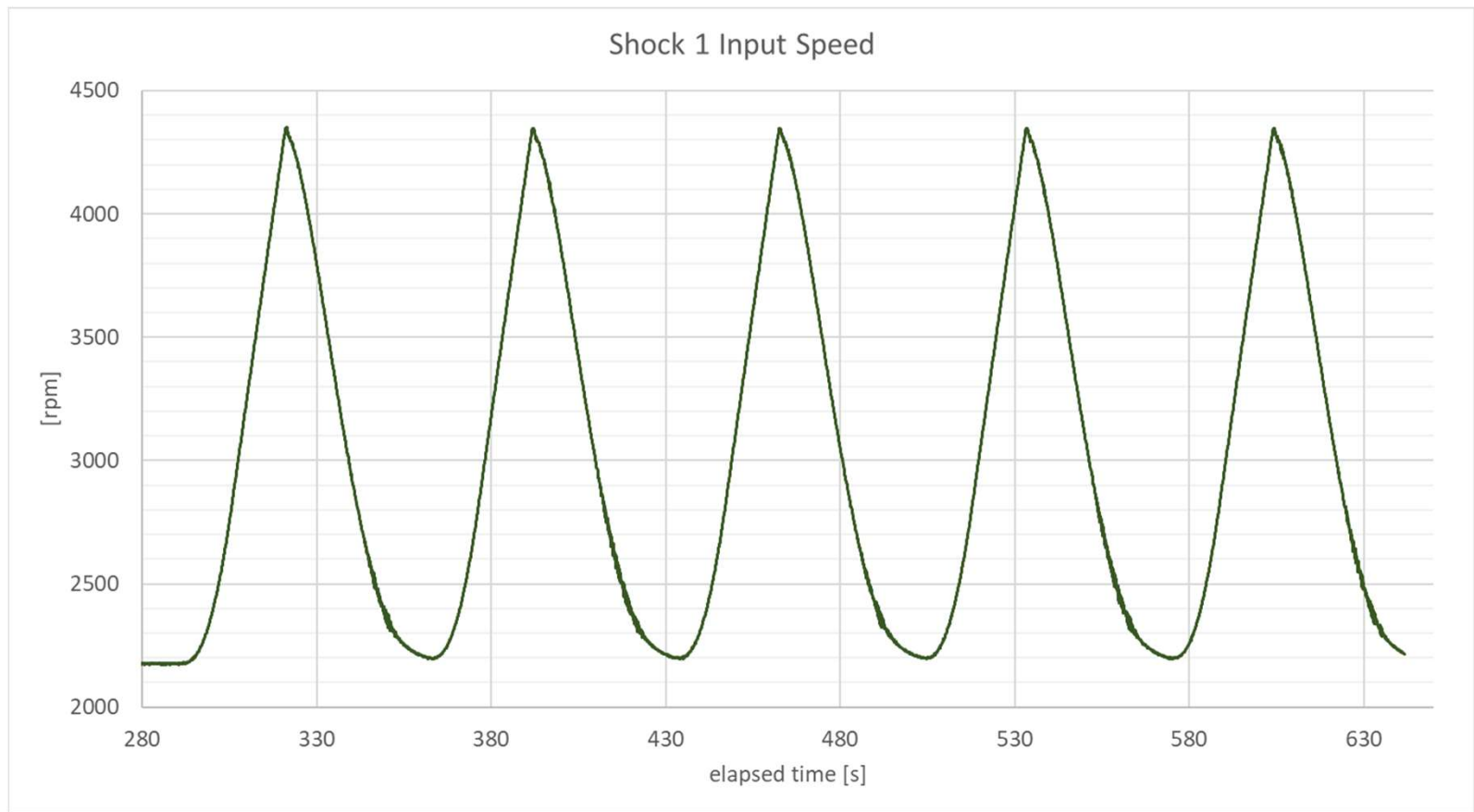
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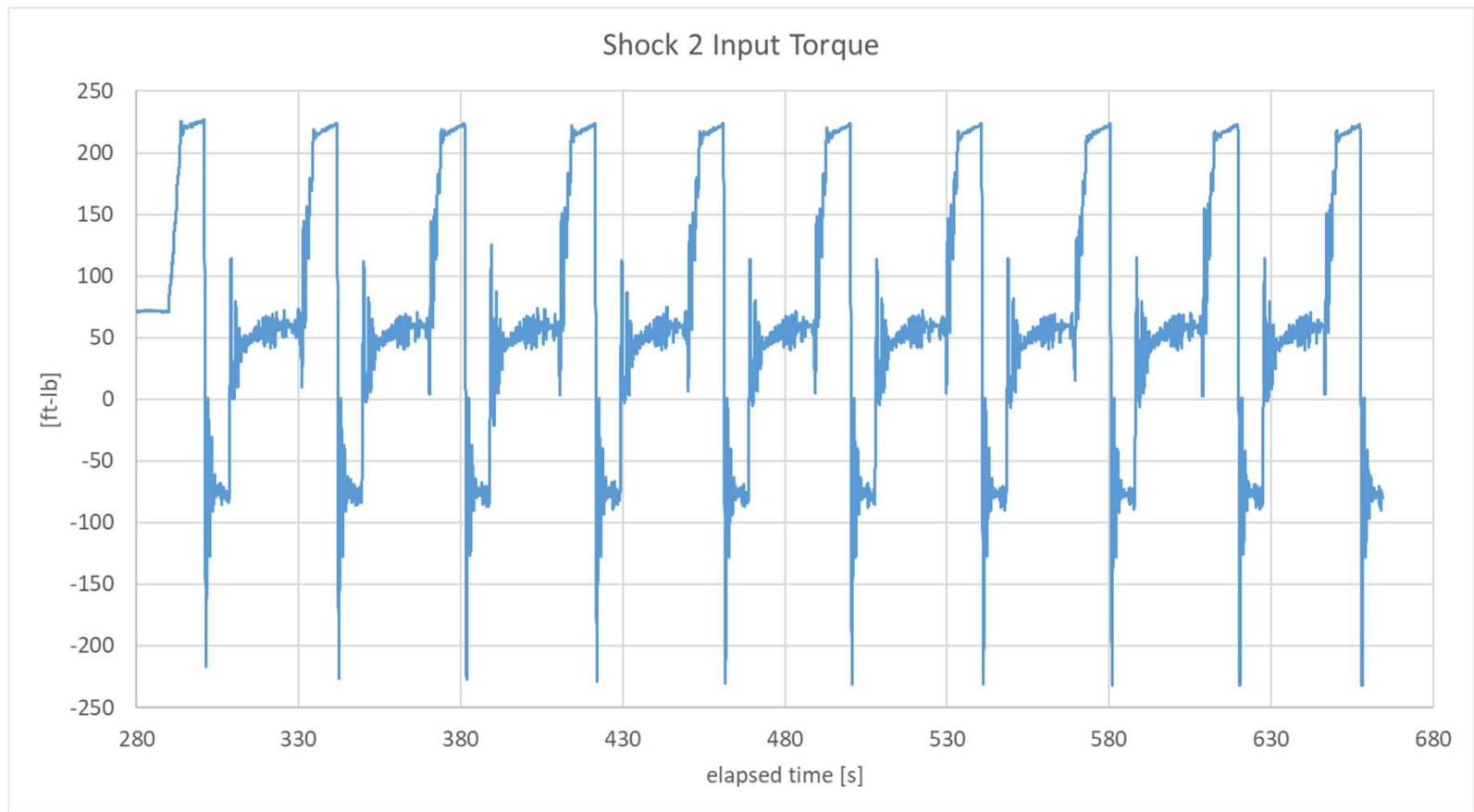
Shock I—01-0009



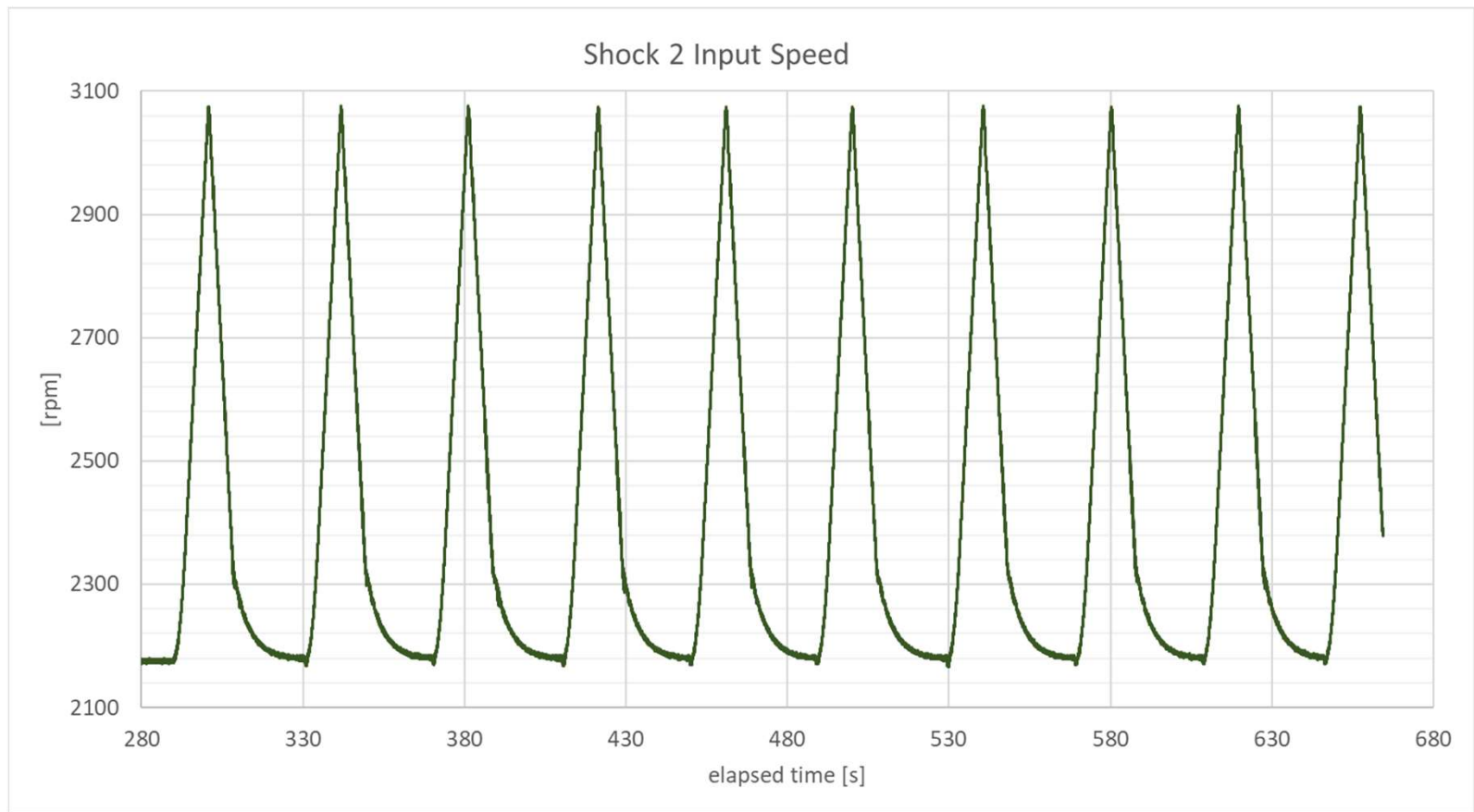
Shock I—01-0009



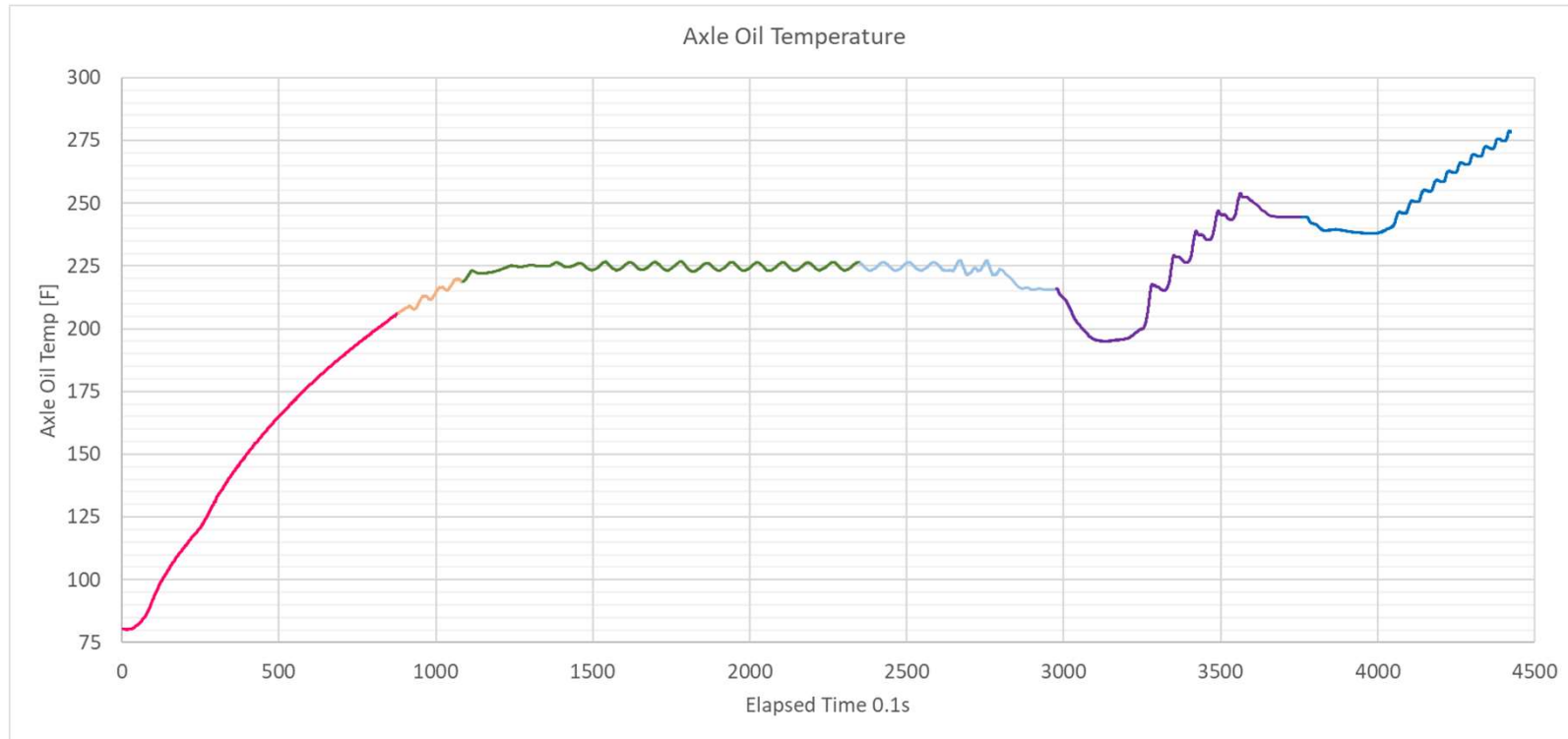
Shock 2—01-0009



Shock 2—01-0009



Temperature Plot—01-0009



| Phase | Min Temp | Max Temp |
|---------|----------|----------|
| Shock 1 | 200.6 | 252.3 |
| Shock 2 | 241.3 | 278.7 |



Test Number 01-0010, TMC 113 (Discrimination Oil)



Stats—Conditioning 01-0010

| Conditioning 1 | | | |
|----------------------|--------|-------------------|------|
| Input Torque [ft-lb] | | Input Speed [rpm] | |
| Target | 60 ± 5 | Target | 2363 |
| Avg | 59.6 | Avg | 2361 |
| Min | 58.5 | Min | 2357 |
| Max | 61.0 | Max | 2365 |

| Conditioning 2 | | | | | | | |
|---------------------------------|-------|---------------------------------|-------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| Target | | Target | | Target | 2363 | Target | 1582 |
| Avg | 112.8 | Avg | -56.6 | Avg | 2366 | Avg | 1581 |
| Min | 112.2 | Min | -58.4 | Min | 2365 | Min | 1581 |
| Max | 113.1 | Max | -54.9 | Max | 2366 | Max | 1582 |

| Conditioning 3 | | | |
|----------------------|--------|-------------------|------|
| Input Torque [ft-lb] | | Input Speed [rpm] | |
| Target | 70 ± 5 | Target | 3350 |
| Avg | 69.9 | Avg | 3346 |
| Min | 68.4 | Min | 3343 |
| Max | 71.1 | Max | 3350 |

| Conditioning 4 | | | | | | | |
|---------------------------------|-------|---------------------------------|-------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| Target | | Target | | Target | 3350 | Target | 2754 |
| Avg | 114.7 | Avg | -62.4 | Avg | 3351 | Avg | 2753 |
| Min | 114.0 | Min | -68.9 | Min | 3349 | Min | 2752 |
| Max | 116.0 | Max | -58.6 | Max | 3354 | Max | 2753 |



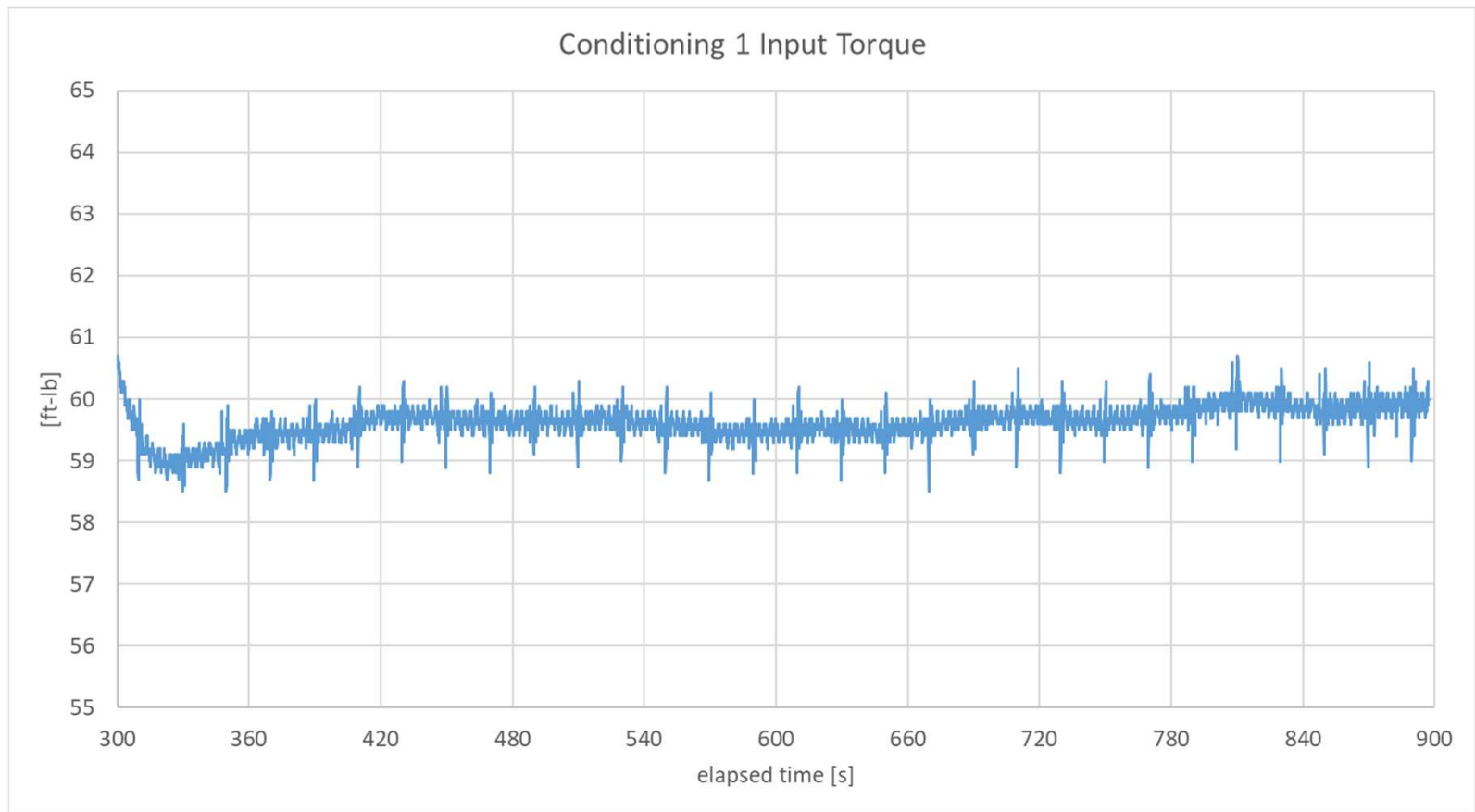
Stats—Shocks 01-0010

| Shock 1 | | | | | | | |
|---------------------------------|-------|---------------------------------|-------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| <i>Target</i> | | <i>Target</i> | | <i>Target</i> | 4316 | <i>Target</i> | 2178 |
| Avg | 235.4 | Avg | -65.3 | Avg | 4349 | Avg | 2191 |
| Min | 234.3 | Min | -66.3 | Min | 4348 | Min | 2171 |
| Max | 237.0 | Max | -63.6 | Max | 4349 | Max | 2196 |

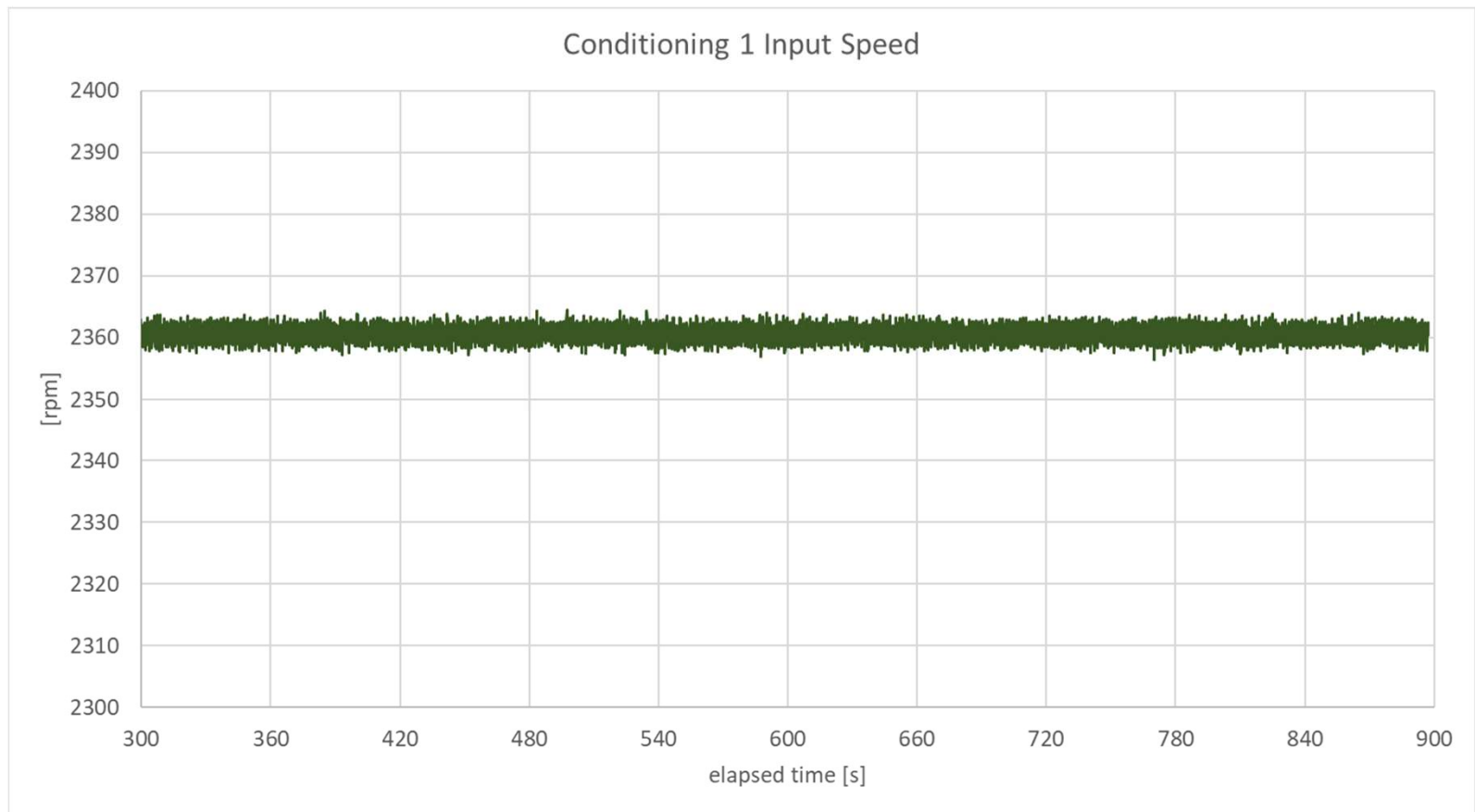
| Shock 2 | | | | | | | |
|---------------------------------|-------|---------------------------------|--------|---------------------------|------|---------------------------|------|
| Peak Input Torque Drive [ft-lb] | | Peak Input Torque Coast [ft-lb] | | Maximum Input Speed [rpm] | | Minimum Input Speed [rpm] | |
| <i>Target</i> | | <i>Target</i> | | <i>Target</i> | 3083 | <i>Target</i> | 2178 |
| Avg | 226.1 | Avg | -224.8 | Avg | 3075 | Avg | 2168 |
| Min | 225.1 | Min | -228.6 | Min | 3074 | Min | 2167 |
| Max | 227.1 | Max | -214.6 | Max | 3076 | Max | 2172 |



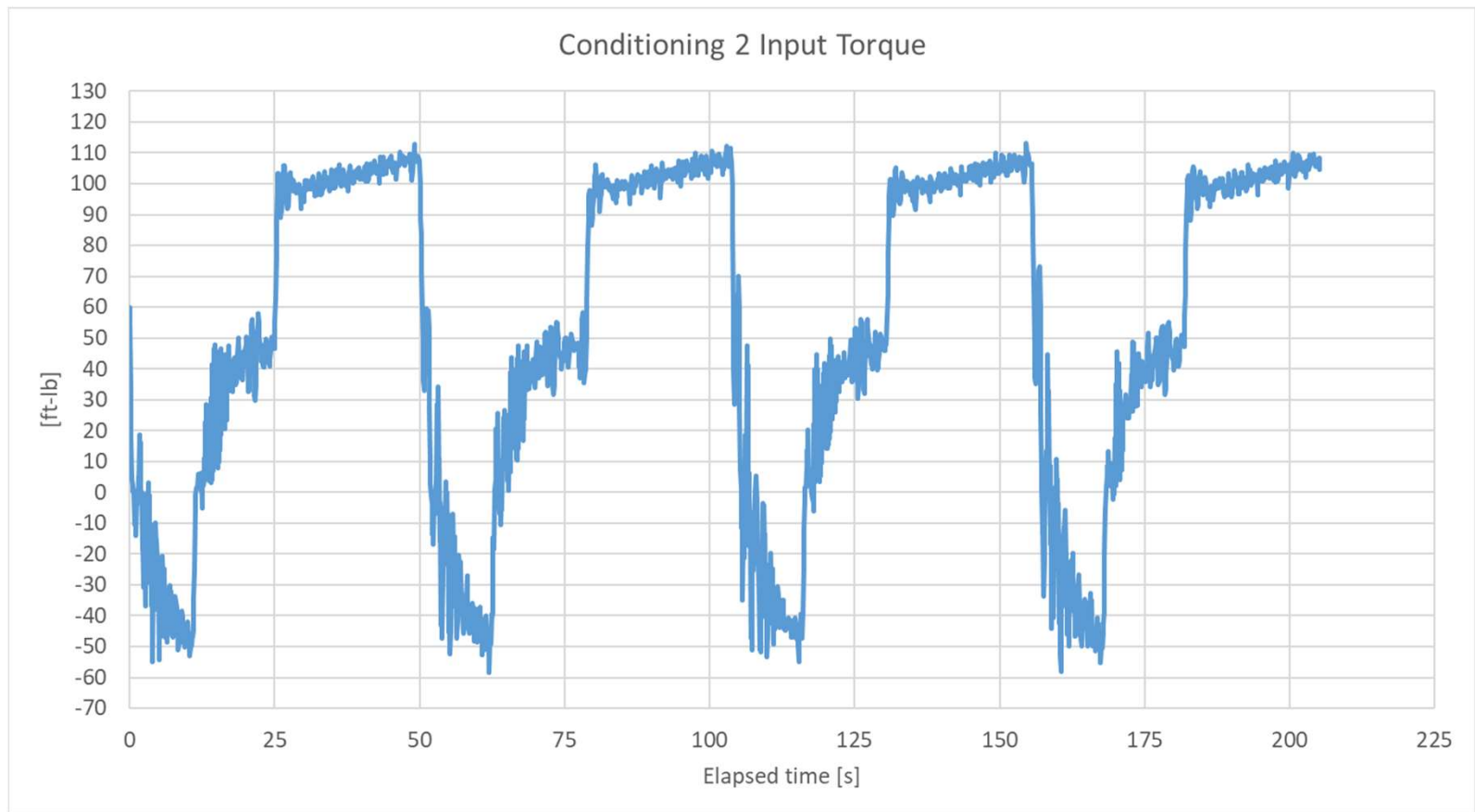
Conditioning I—01-0010



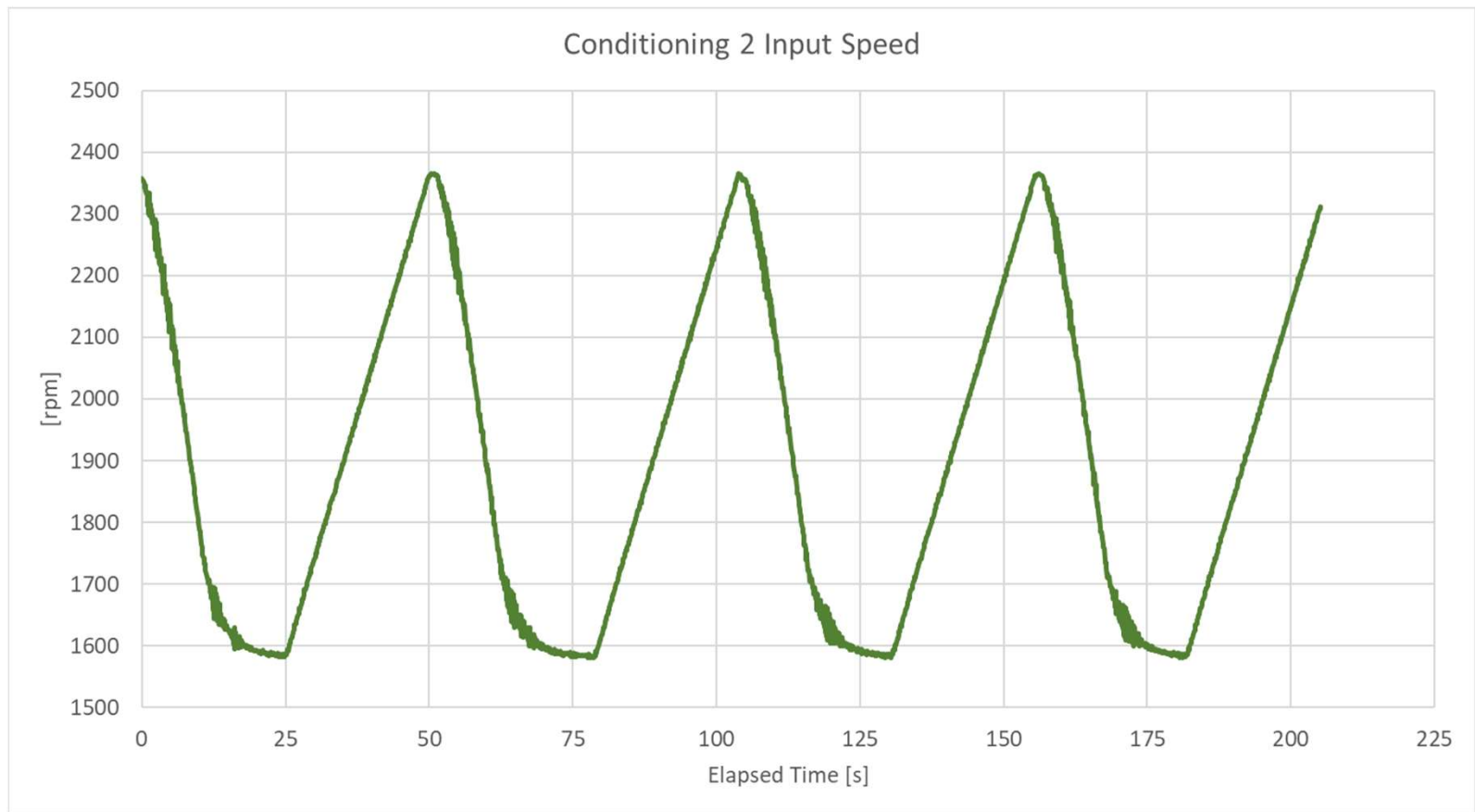
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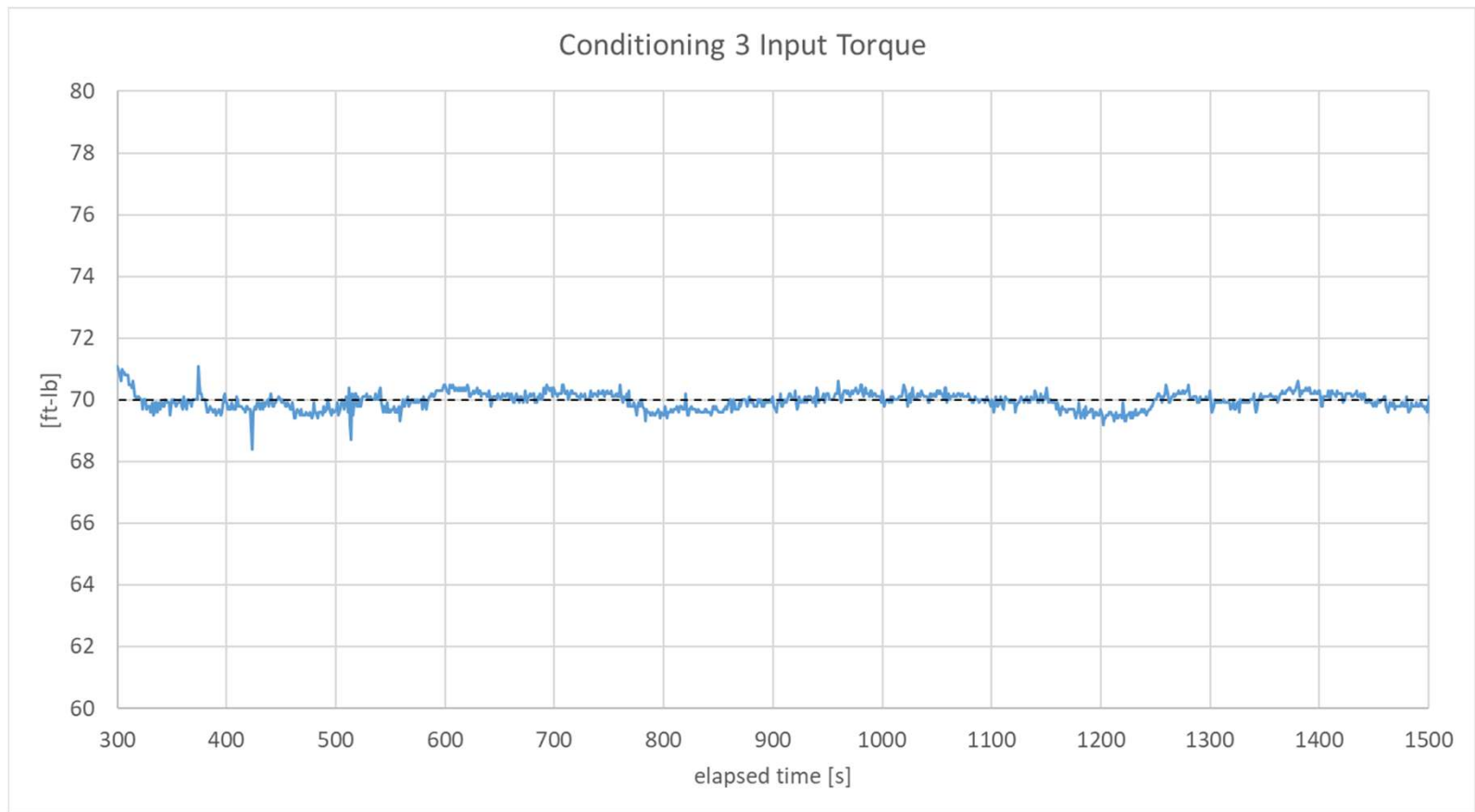
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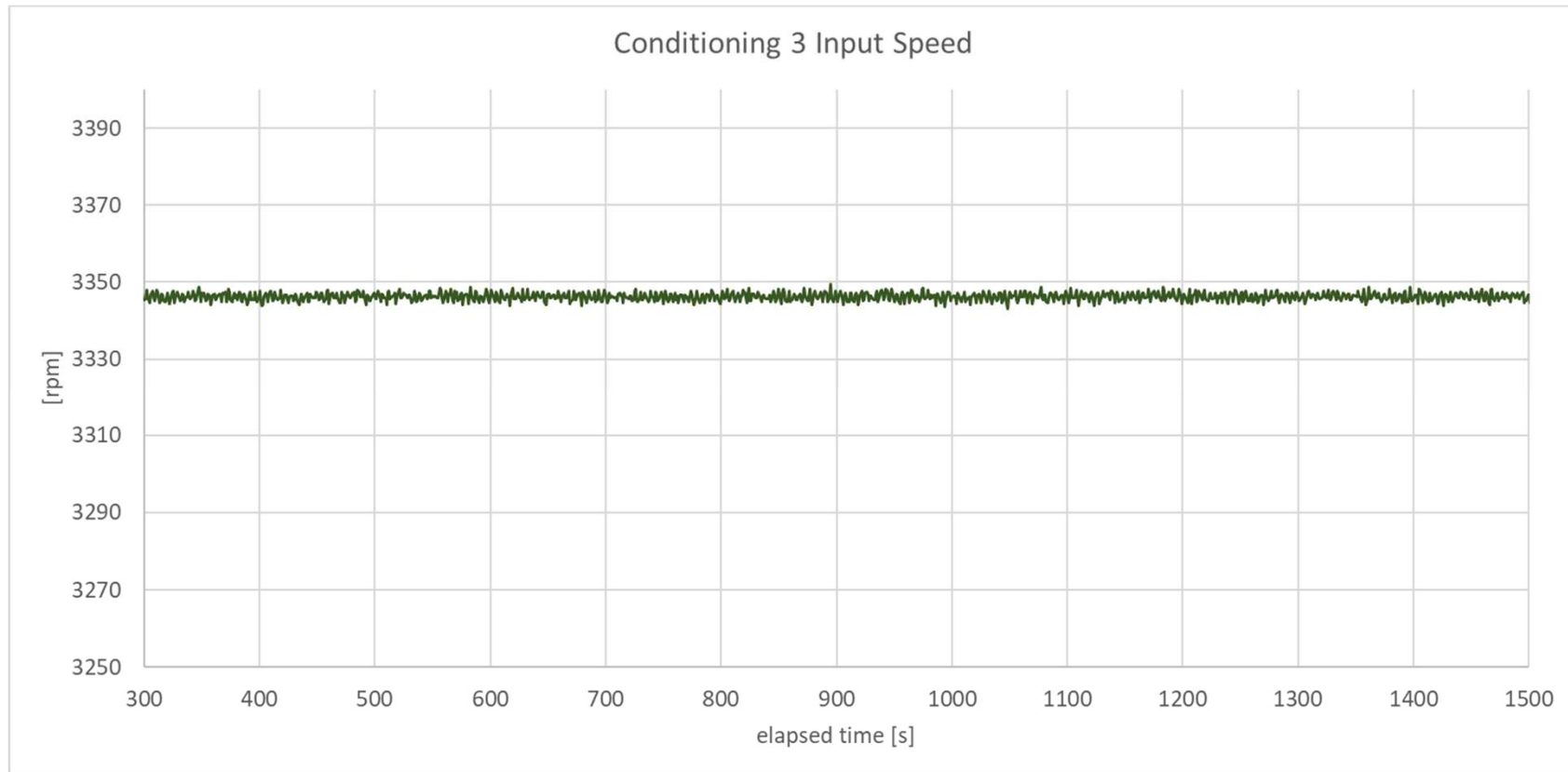
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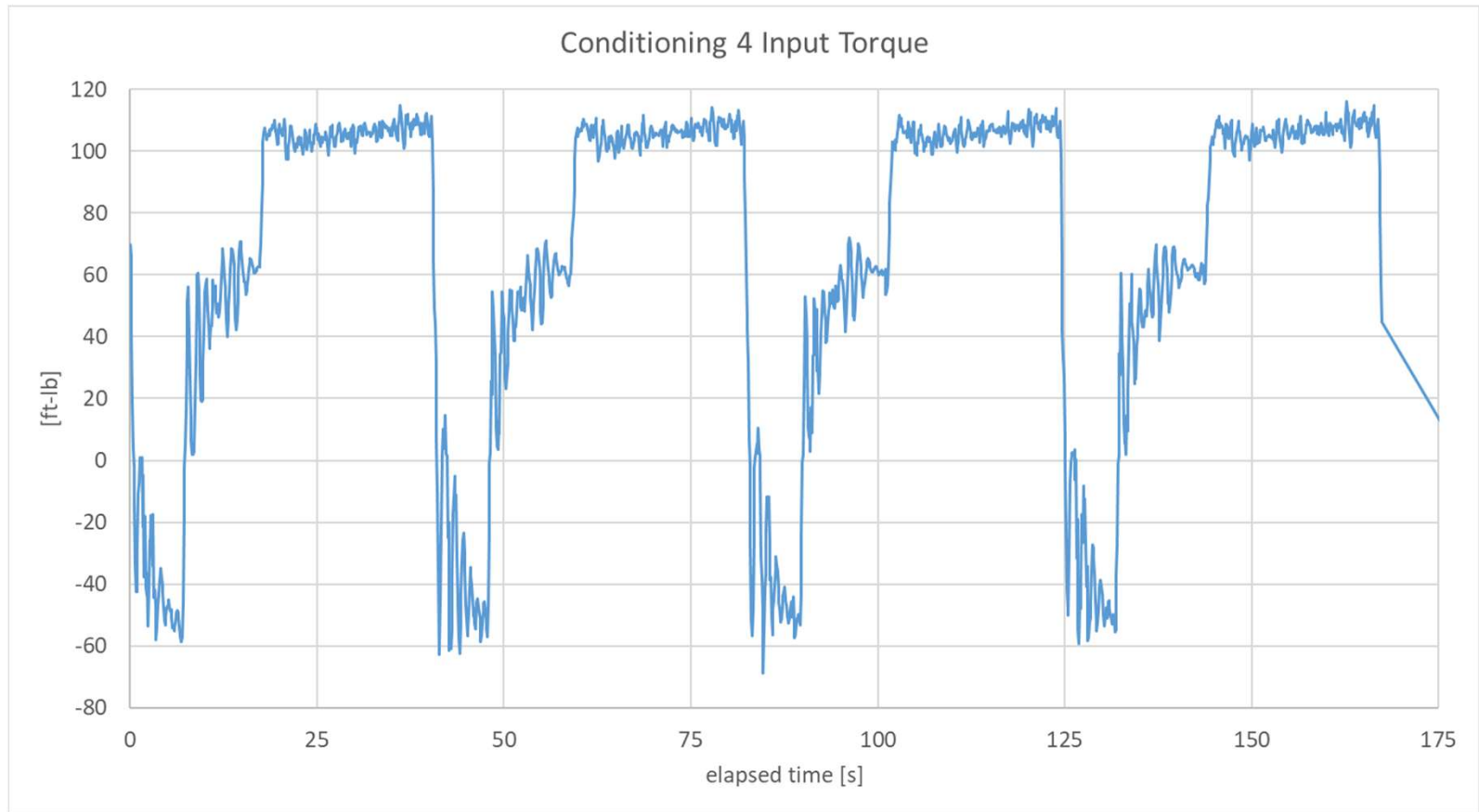
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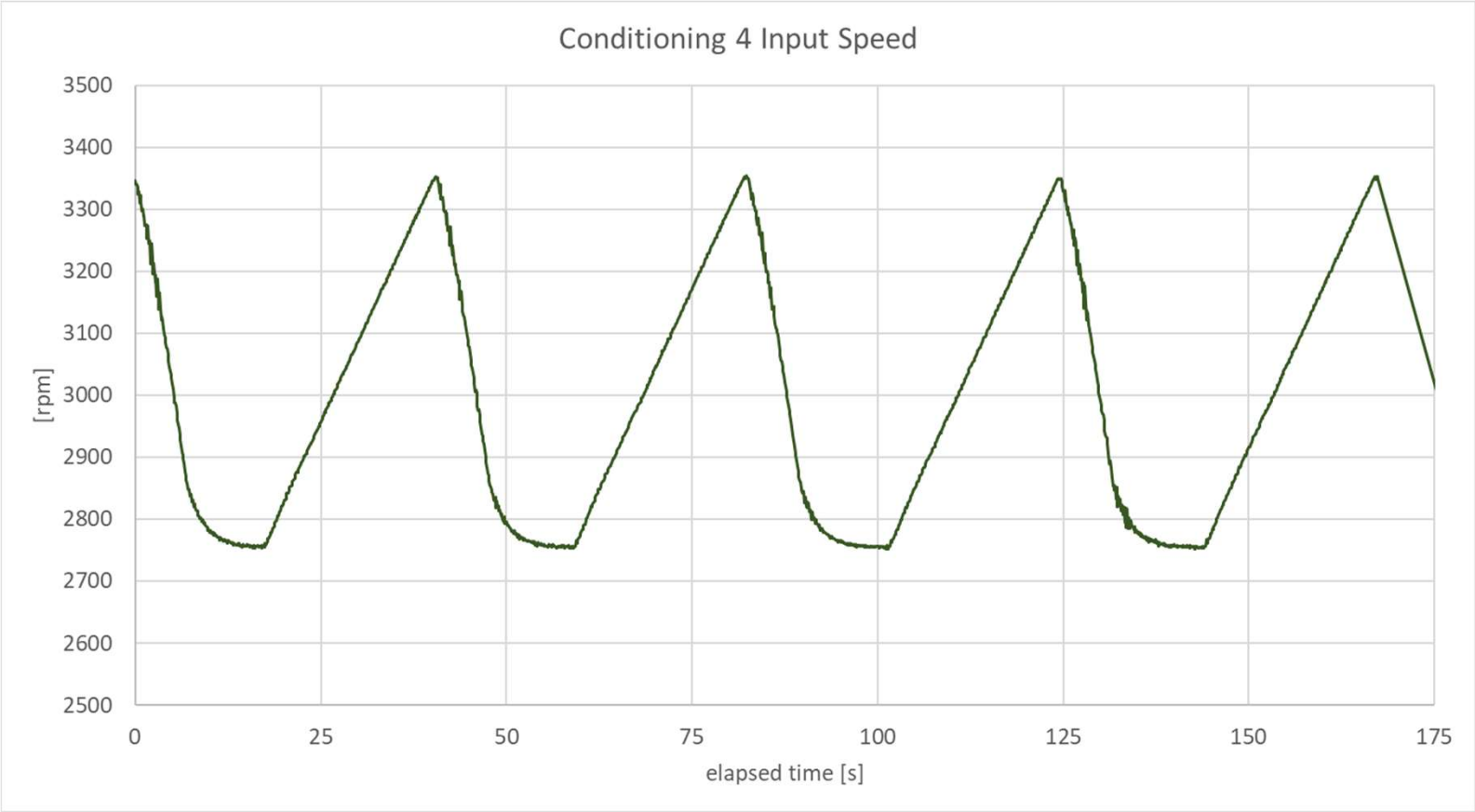
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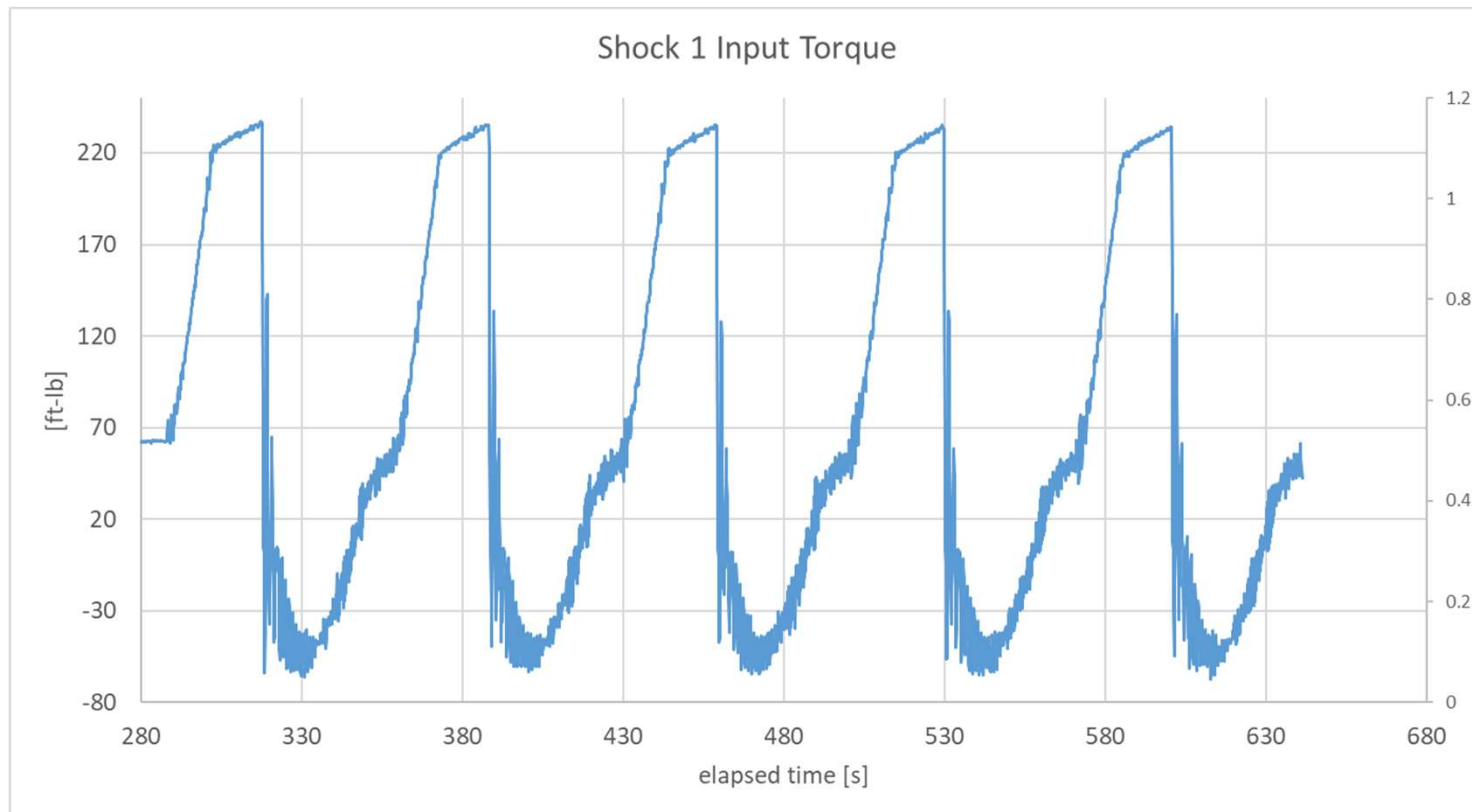
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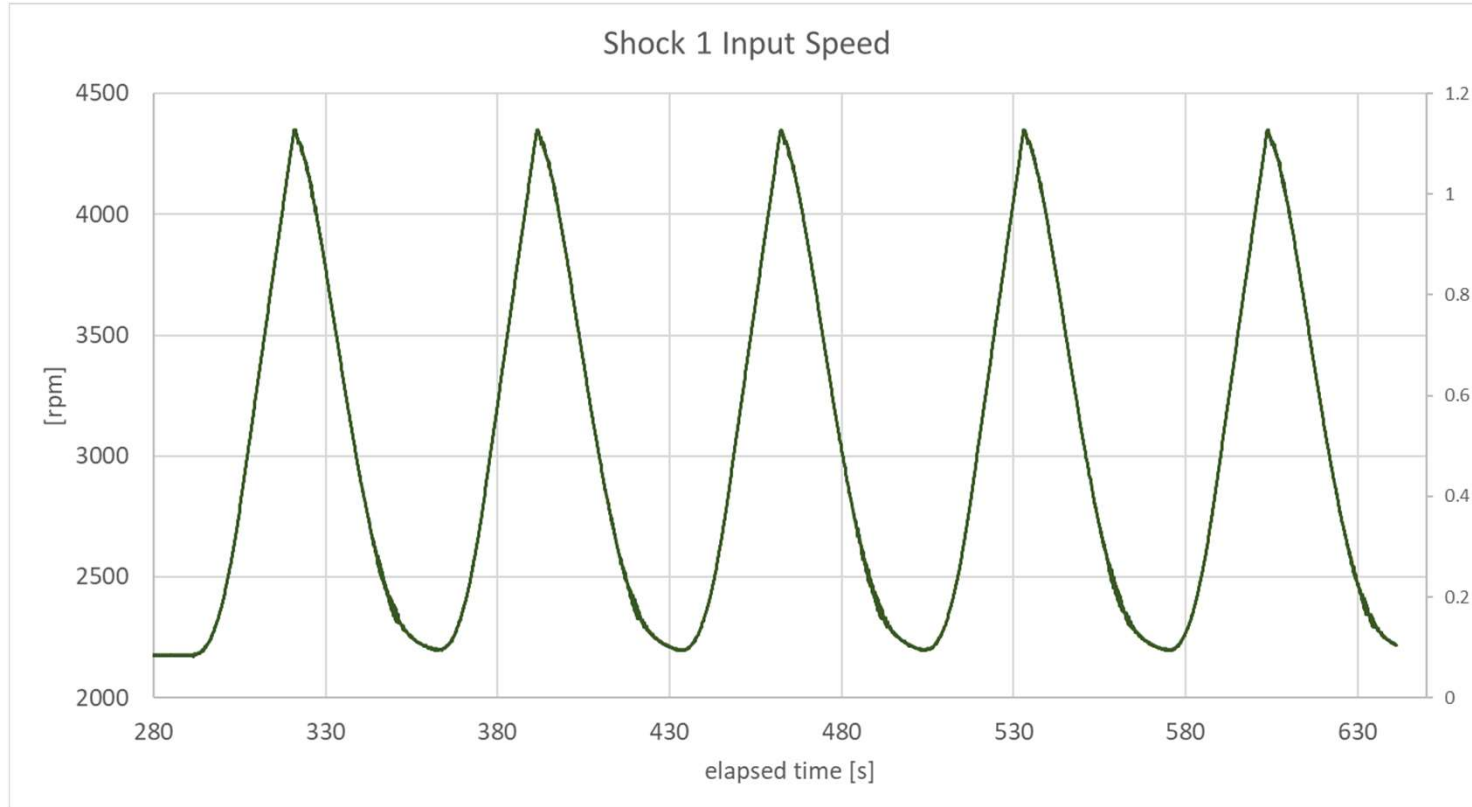
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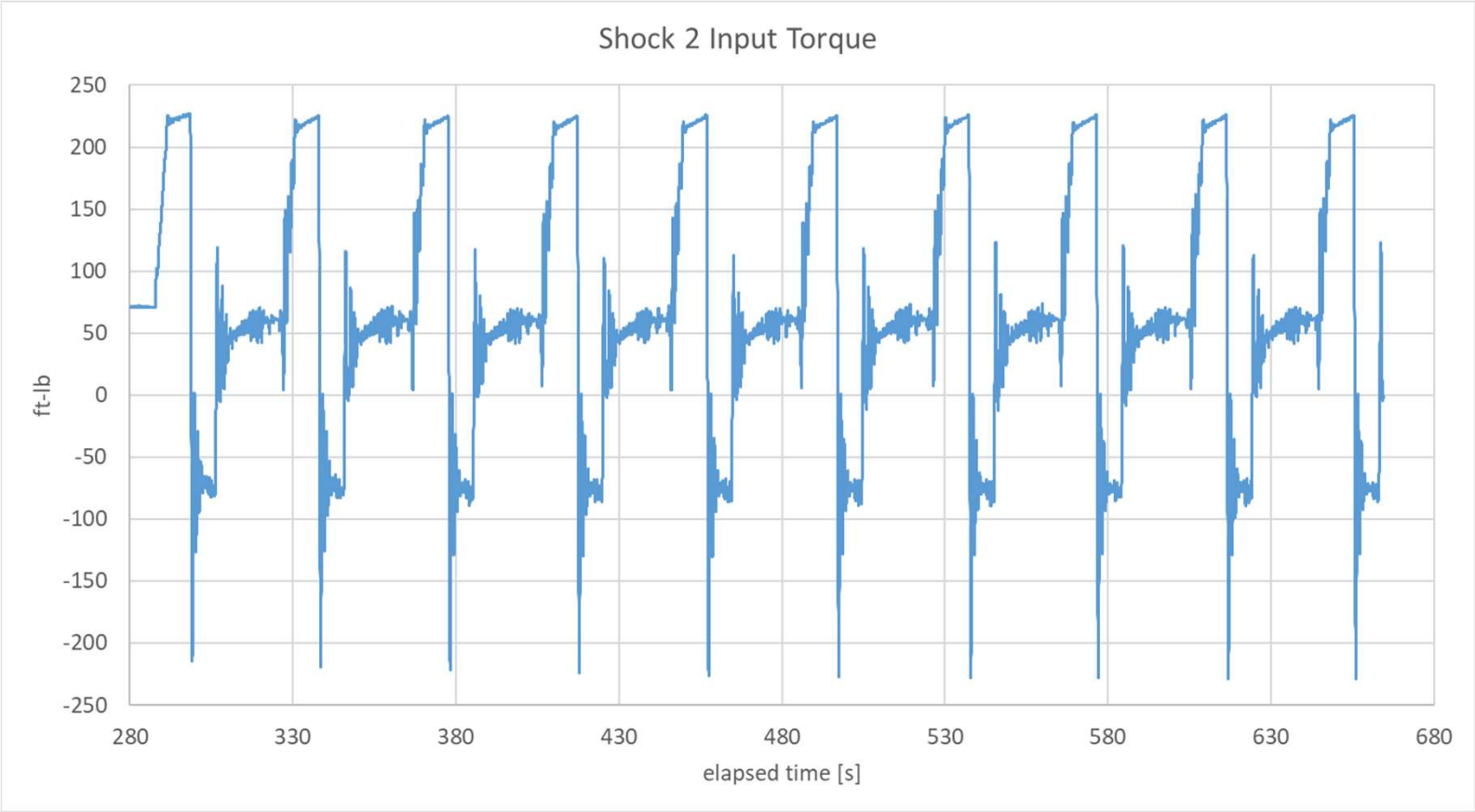
Shock I—01-0010



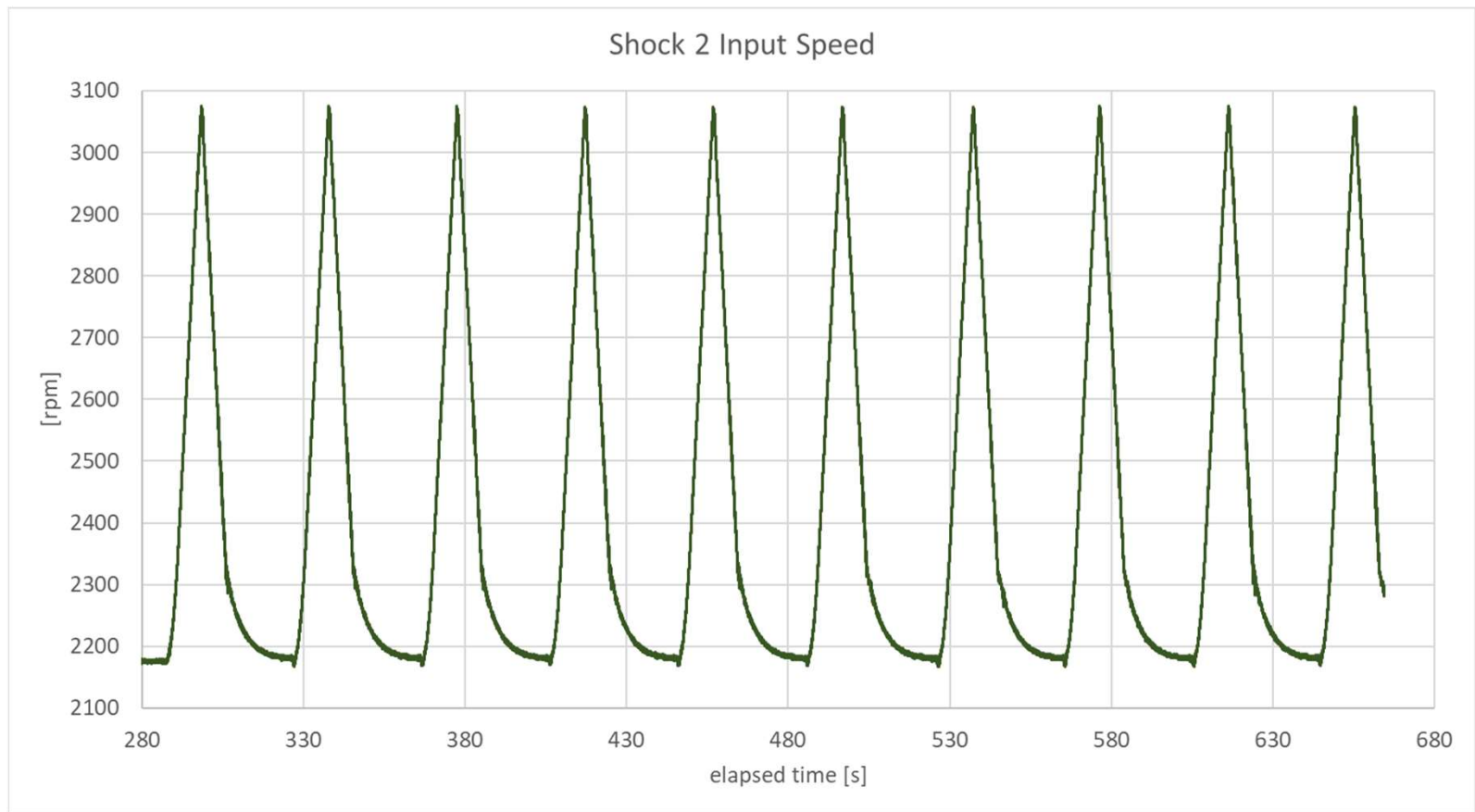
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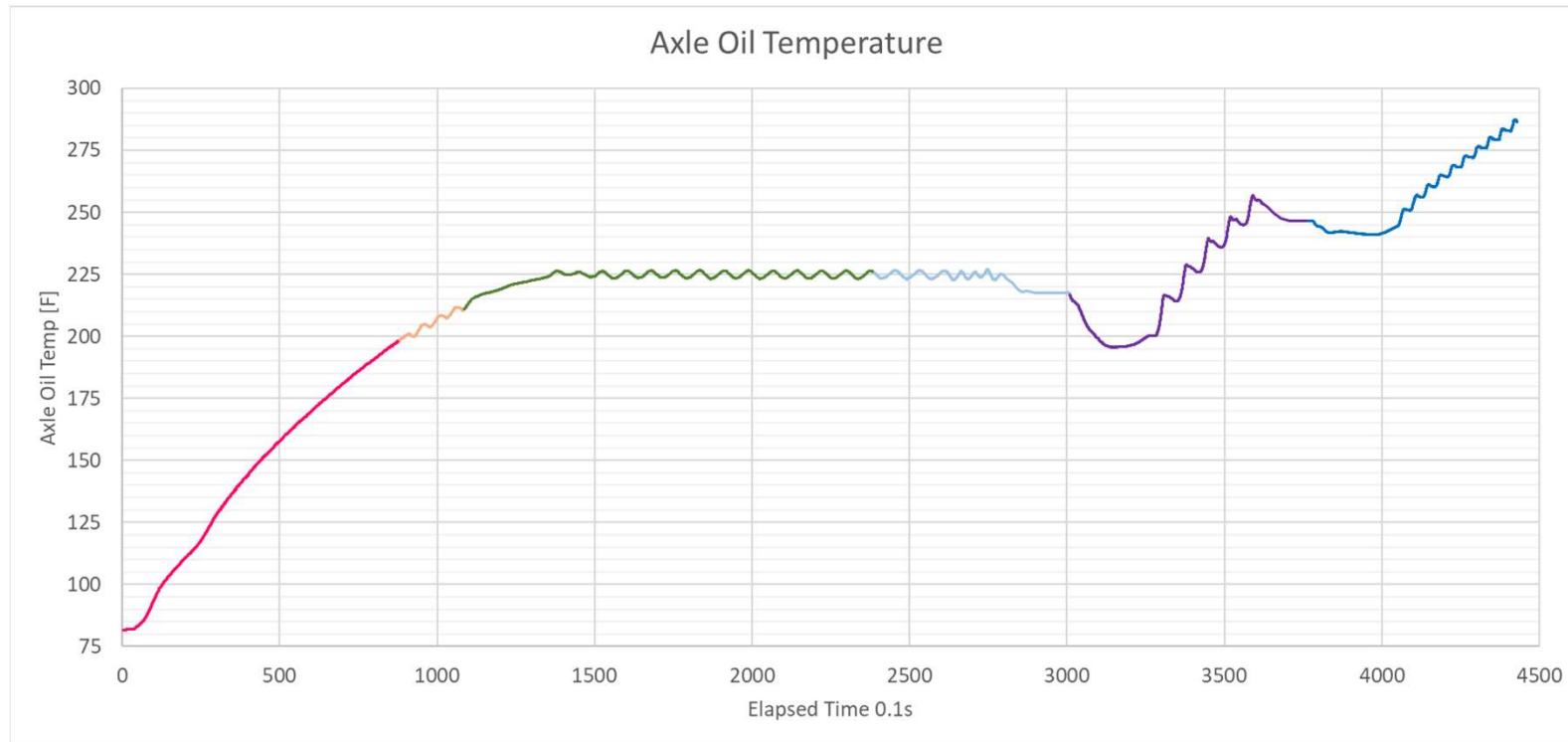
Shock 2—01-0010



Shock 2—01-0010



Temperature Plot—01-0010



| Phase | Min Temp | Max Temp |
|---------|----------|----------|
| Shock 1 | 200.4 | 255.0 |
| Shock 2 | 245.6 | 287.1 |

