CyFlex® Locomotive Smoke Cycle Report

Version 6

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Developed by Transportation Laboratories

Version History

Version	Date	Revision Description
1	1/25/2016	Initial publication
2	8/23/2018	Format to SGS brand
3	1/6/2020	Retrofit to new template
4	9/29/2021	Added hypertext linked cross-references to cyflex.com usage help for `fedSmokeHdr` and `floger` in *Section 2 Test Cell Setup* on page 2 Removed `locoSmokeRep` usage content and replaced with hypertext link to cyflex.com usage help in *Section 3 Analysis and Reporting* on page 5
5	5/25/2022	Updated all hypertext linked cross-references to cyflex.com usage help descriptions
6	2/7/2024	Rebrand to TRP Laboratories

Document Conventions

This document uses the following typographic and syntax conventions.

- Commands, command options, file names or any user-entered input appear in Courier type. Variables appear in Courier italic type.

  Example: Select the `cmdapp-`*`relVersion-buildVersion`*`.zip` file….

- User interface elements, such as field names, button names, menus, menu commands, and items in clickable dropdown lists, appear in Arial bold type.

  Example: **Type**: Click **Select Type** to display drop-down menu options.

- Cross-references are designated in Arial italics.

  Example: Refer to *Figure 1*…

- Click intra-document cross-references and page references to display the stated destination.

  Example: Refer to *Section 1* Overview on page 1.

  The clickable cross-references in the preceding example are *1*, *Overview*, and on page 1.

CyFlex Documentation

CyFlex documentation is available at https://cyflex.com/. View **Help & Docs** topics or use the **Search** facility to find topics of interest.

Table of Contents

1 Overview

The `locoSmokeRep` task generates a Locomotive Smoke Cycle report that is the result of data analysis of each mode within a data logger file.

2 Test Cell Setup

The following executables must be installed for the version of software used at the test cell:

- `locoSmokeRep`, refer to *Section 3 Analysis and Reporting* on page 5
- `fedSmokeHdr`, refer to cyflex.com usage help for `fedSmokeHdr`
- `floger`, refer to cyflex.com usage help for `floger`

A `logr_specs.lsr` file should be within the `/specs directory`. This file defines what is to be within the header of the logger file. Refer to *Section 2.2 Logger Specification* on page 3.

The `fedSmokeHdr` task is executed within a `gp_test` file. The `fedSmokeHdr` task generates the header of the Locomotive Smoke logger file. The spec filename argument of the task should be `logr_specs.lsr`.

The `floger` task is executed within a `gp_test` file. The `floger` task generates the logger file with real-time test data.

2.1 Data Logging

The mechanism used to acquire data during the locomotive smoke cycle is the data logger task `floger`. This task is configured to acquire data at 10 Hz for the duration of each individual cycle. The channels of data acquired during the test are:

- `Mode Number`
- `Engine Speed`
- `Speed Error`
- `Dyno Torque`
- `Smoke_R`
- `Fuel Inlet Temperature`
- `Air Inlet Temperature`
- `Throttle Command`
- `Smoke_L`

These channels are required for the test results to be analyzed and reported. The data logging task may be modified to include additional channels as desired by the test users. The data logger task's specifications are in a file called `logr_spec.lsr.` See *Section 2.2 Logger Specification* on page 3 for an example.

2.2 Logger Specification

```
@DESCRIPTION
        # Computed expressions may be entered.
   'locoSmokeHdr Test      TC1'

@FILENAME
        # Computed expressions may be entered.
   "'lsmk.1.' + smk_test + '.' + smk_repeat + '.' + smk_cycle"

@SCAN_INTERVAL
        # time between scans eg. 1[sec] Computed expressions may be
entered
   50[msec]

@MAX_SCANS
        #  The maximum number of times to sample
   36000

@RELEASE_EVENT
        # Any existing event name may be entered.
   rels_it

@STOP_EVENT
        # Any existing event name may be entered.
   stop_it

@START_EVENT
        # Any existing event name may be entered.
   start_it

@PACKED
        # Should output be comma separated? (yes,no)
   YES

@FEDERAL_SMOKE
 /specs/logr_specs.lsr
```

```
#-----------------------------------------------------------------------
#
#                                "DO NOT"
#    Change First 9 Channels or an error will result in locoSmokeRep
#         Required Channels for Locomotive Smoke Cycle Report
#          lines 1-9 (test_mode - thr_pos) are required
#-----------------------------------------------------------------------
-#
@SCAN_LIST
     # CYFLEX variable label[optional units]  [optional format or
statistical member]
   Fed_Smoke_Md
   ANA_spd
   ANA_spd_ER
   ENG_TORQ
   opac_R
   fpmp_inT
   cmp_inT_av
   Throt_real
   opac_L

#-----------------------------------------------------------------------
-#
# Optional Channels
# variables and order of variables must appear in Test Plan
#-----------------------------------------------------------------------
-#

   Throttle_CM
   int_mnfP_RF
   int_mnfP_RR
   int_mnfP_LF
   int_mnfP_LR
   int_mnfT_RF
   int_mnfT_RR
```

3 Analysis and Reporting

The data logged by the locomotive smoke cycle is analyzed and a report is generated at the completion of a test cycle. The analysis consists of sorting and processing the locomotive smoke data. If a – appears within the report, the data value was unable to be calculated for the mode. Refer to the following for additional information:

- *Section 3.1 Example Output Report* below
- *Section 4 Analysis Process* on page 7

While the analysis and report generation process occurs automatically at the end of each test, the option is provided to start it manually with the `locoSmokeRep` command:

```
locoSmokeRep [options]
```

where options take the form of a three-character name, an equal sign, and a value string, e.g., `cyc=1`. Refer to cyflex.com usage help for `locoSmokeRep`.

Three related CYFLEX Variables are created in the Performance Labels specs:

```
smk_test   smoke test #
smk_repeat smoke test repeat #
smk_cycle  smoke test cycle #
```

Notes:

- `smk_test` should be set to 1 at the beginning of a series of smoke tests. It should then automatically advanced in the test script file.
- `smk_repeat` should be set to `0` and left there unless a test is repeated. It should then be advanced from the console for each repeat of the test, and finally reset to 0 before the next test starts.
- `smk_cycle` is set automatically to 1, 2 and 3 as the test script performs the smoke cycles.

3.1 Example Output Report

```
* * Locomotive Smoke Cycle Report - Test 8    Cycle 3


 Test Cell: 50      6/24/2008  14:30:54      CyFlex      v1.0

 Smoke File: lsmk.3.8.158.3       PAM: qsk50_cert2_2s.98
 GP Test:


 SMOKE AVERAGES:    Left Exhaust Stack

         Notch   3 Sec Reading        30 Sec
                    Integrated        Moving      120 to 180 Sec
                         Value       Average      Average
  ---------------------------------------------------------------
```

Low Idle	6.2167	2.0759	1.9234
Normal Idle	-	-	-
Dynamic Idle	-	-	-
Notch 1	-	-	-
Notch 2	-	-	-
Notch 3	-	-	-
Notch 4	-	-	-
Notch 5	-	5.2283	-
Notch 6	51.9338	3.7037	-
Notch 7	-	-	-
Notch 8	-	-	-

SMOKE AVERAGES: Right Exhaust Stack

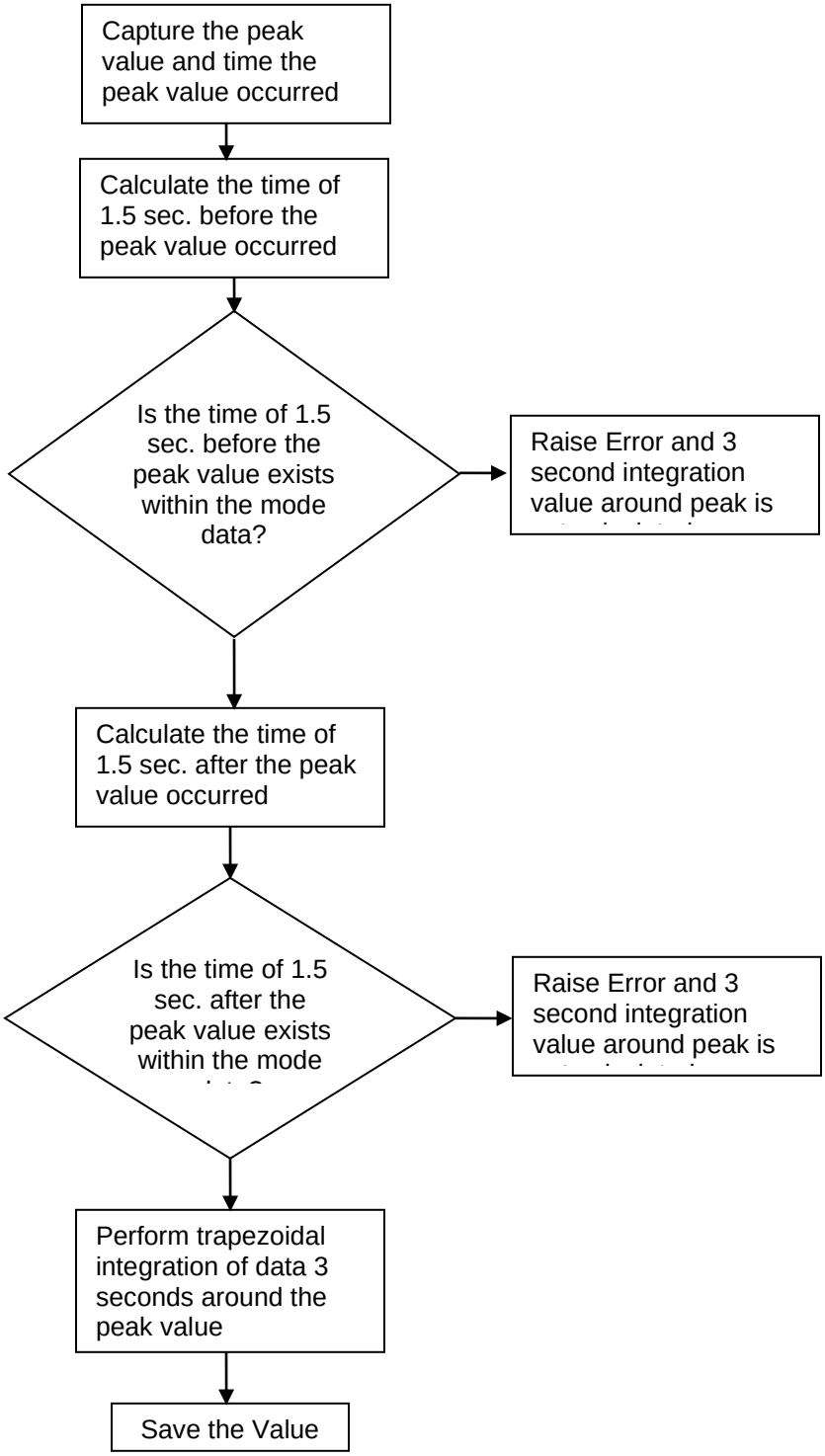
Notch	3 Sec Reading Integrated Value	30 Sec Moving Average	120 to 180 Sec Average
Low Idle	7.3712	2.4669	2.3916
Normal Idle	-	-	-
Dynamic Idle	-	-	-
Notch 1	-	-	-
Notch 2	-	-	-
Notch 3	-	-	-
Notch 4	-	-	-
Notch 5	17.3413	5.2283	-
Notch 6	12.6827	3.7859	-
Notch 7	-	-	-
Notch 8	-	-	-

4 Analysis Process

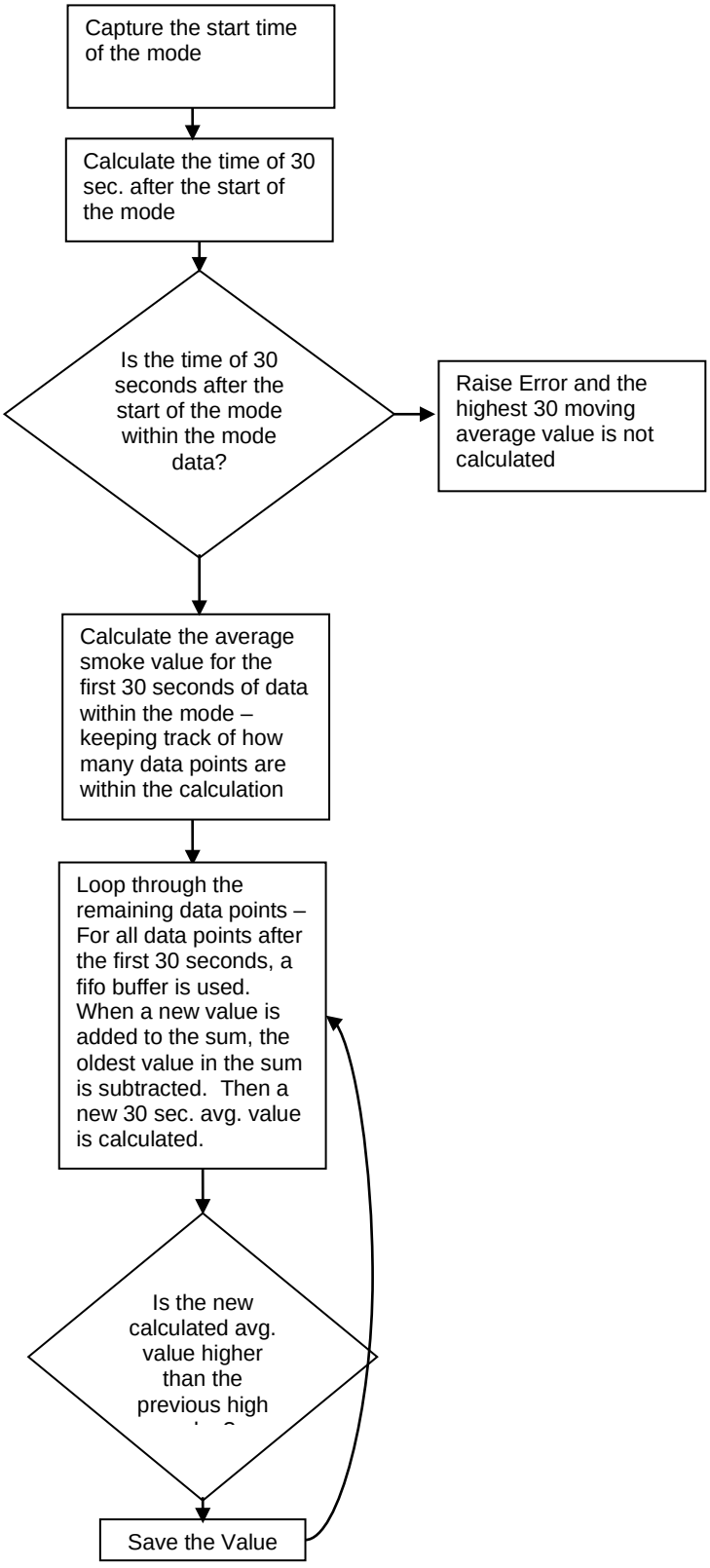
For each mode, for each stack, the following calculations are performed:

- 3 second integration of data around the peak
- Highest 30 second average
- Average of Smoke data between 120 and 180 seconds

4.1 3 Second Integration Around the Peak Calculation Process



4.2 Highest 30 Second Moving Average Calculation Process



4.3 Average of 120 to 180 Seconds Calculation Process