**Material Replacement Wizard**

**Pumping and Estimations**

**Triplex**

Written by: Slava Chuhovich

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# Background

In order for a new Material Replacement wizard to perform the pipe washing process more efficiently and less time consuming, new pumping order algorithm was introduced, that divides the pumps, which are needed for the process, into different “sections” and perform a required number of washing cycles in each section.

# Pumping sections algorithm

After user selects the required materials for replacement, MRW Pipeline receives those selections and the number of required washing cycles from MRW Matrix (XML), processes the data and outputs the number of cycles to perform for each pipe and its corresponding cartridge / pump.

Each pipe “Y” line, which is connected to its corresponding print-block chamber, is logically separated into “short” and “long” pipes for efficient washing and washing cycles assignment.

For example, the Pipeline output could be as follows:

Short

Washing cycles

10

15

20

3

2

Long

In order for a washing process to be as less time consuming as possible, we divide the pumps into separate groups we call “sections”. Each pumping section consists of pumps with minimal number of washing cycles in each pair (single “Y”). The number of cycles for the entire current section will be the minimal in the section.

When the washing for the current section is finished, we’ll end up with washing for one of the pipes completed, meaning it’s washing cycles will be 0.

We’ll continue in this matter until all washing cycles for all pipes are 0 and entire washing process is completed.

To follow the previous example:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Section | “Y” cycles | | “Y” cycles | | “Y” cycles | | Cycles in current section |
| 1 | 3 | 20 | 2 | 15 | 0 | 10 | 2 |
| 2 | 1 | 20 | 0 | 15 | 0 | 8 | 1 |
| 3 | 0 | 20 | 0 | 14 | 0 | 7 | 7 |
| 4 | 0 | 13 | 0 | 7 | 0 | 0 | 7 |
| 5 | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| done | 0 | 0 | 0 | 0 | 0 | 0 |  |

**Red** – Cycles that participate in current section.

**Blue** – The amount of pumping cycles that will be actually performed. Minimal for the section.

So in each section we’ll finish with “minimal” pump and collect additional pump for next section, ensuring the most time efficient washing process.

# Time and progress estimations

All time and progress estimations are calculated prior the washing process, by taking into consideration the following factors:

* Time / percentage for each section.
* Whether each pump is flooding the chamber or not.
* Time / percentage for each purging cycle.
* Block draining time.

Time estimation for each section is performed according to an amount of washing cycles, which is done in this section and taking into consideration whether each pump is flooding the block or not. If at least one of the pumps in section is flooding the block we’ll use *MRW\_SingleWashingCycleTimeSecFlooding* parameter for single cycle time otherwise we’ll use *MRW\_SingleWashingCycleTimeSecNonFlooding.*

NumOfCycles - Cycles in current section

CyclesTime = NumOfCycles \* SingleWashingCycleTime (flooding or non-flooding)

Purges and draining

PurgesTime = MRW\_NumberOfPurgeCycles \* (MRW\_DelayBetweenPurges + MRW\_EmptyBlockTime)

DrainingTime = MRW\_EmptyBlockTime

Overall times

WashingCyclesTimeSec – Combined time of all sections

OverallTimeEstimation = (PurgesTime + WashingCyclesTimeSec + DrainingTime) / 60 - times are in seconds

DrainingPercent = ((DrainingTime / 60) / OverallTimeEstimation) \* 100

SinglePurgeCyclePercent = (((PurgesTime / 60) / OverallTimeEstimation) \* 100) / MRW\_NumberOfPurgeCycles