



Cairo, Egypt. November 7-8, 2022

# MENAPS 2022

## MIDDLE EAST AND NORTH AFRICA PERFORATING SYMPOSIUM

# Frequently Asked Questions with Answers Regarding Perforating and Energetics



## How Much will the performance vary using RDX explosives vs HMX explosives?

- API RP-19B has performance for HMX but what will happen with RDX?
- HMX has a higher energy output
  - Results will vary based on size and weight of shaped charge
- Papers have been presented on this topic
- Variance in charge performance by as much as 10 – 15% depending on the shaped charge
- Hole size variation with RDX outperforming at times
- Depth of penetration variation with HMX outperforming most of the time
  - HMX and tungsten play a key role with the depth performance
  - $KE=1/2MV^2$
  - Det velocity of HMX vs RDX
- There is not one answer that will work on this

## May you use RDX Detonating Cord with HMX Shaped Charges or vice-versa?

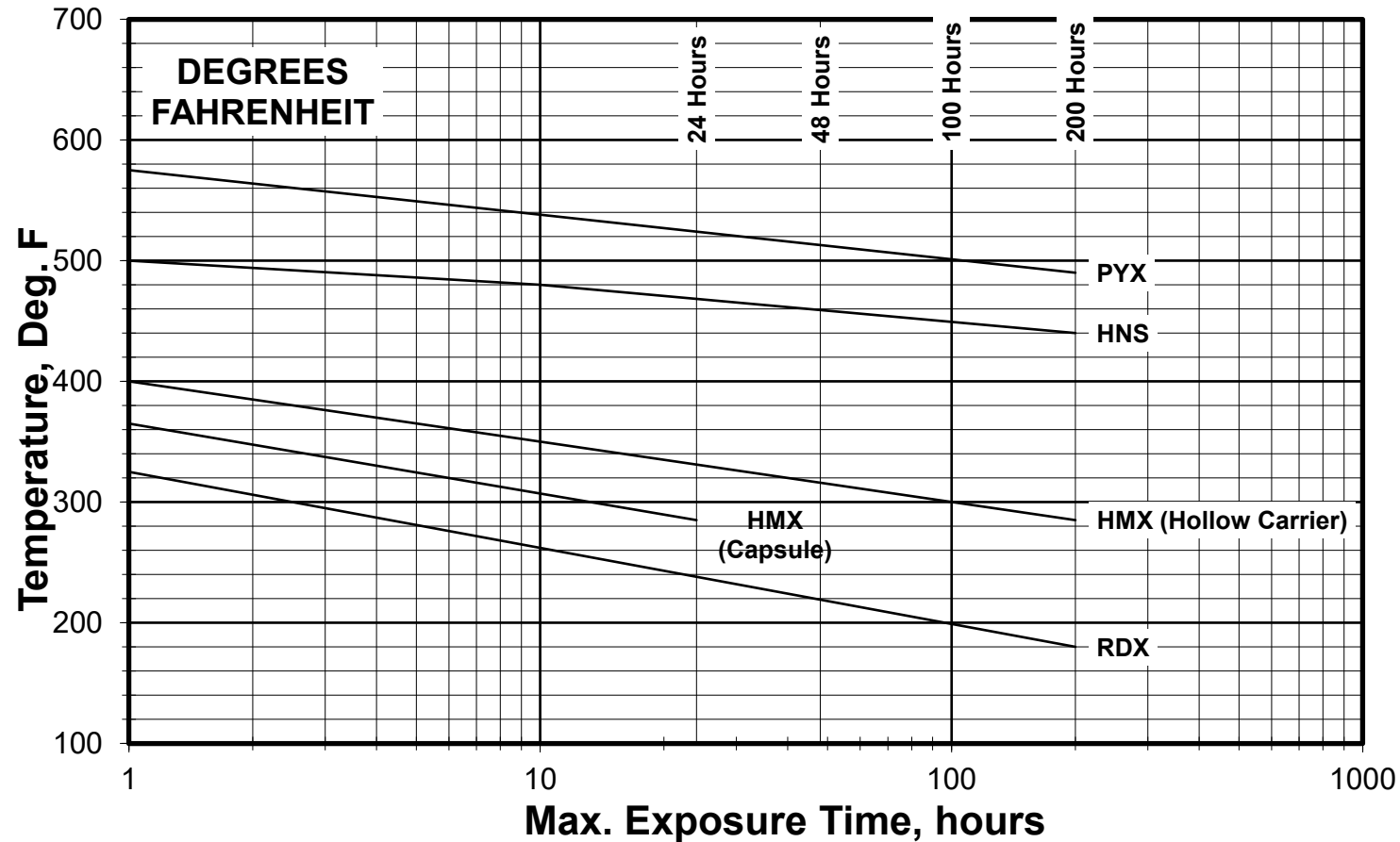
- Best to consult the shaped charge manufacturer in many instances
- Some perforating gun systems will require a XHV (Extra-High Velocity) det cord and both RDX and HMX are manufactured in XHV
- Basic rule of thumb – know your Bottom Hole Temperature – make sure all explosives will work at that temperature
- RDX Det Cord can be used with HMX shaped charges and HMX Det Cord can be used with RDX shaped charges
  - Be sure to meet requirements of perforating gun system you are using



# Time / Temperature Chart



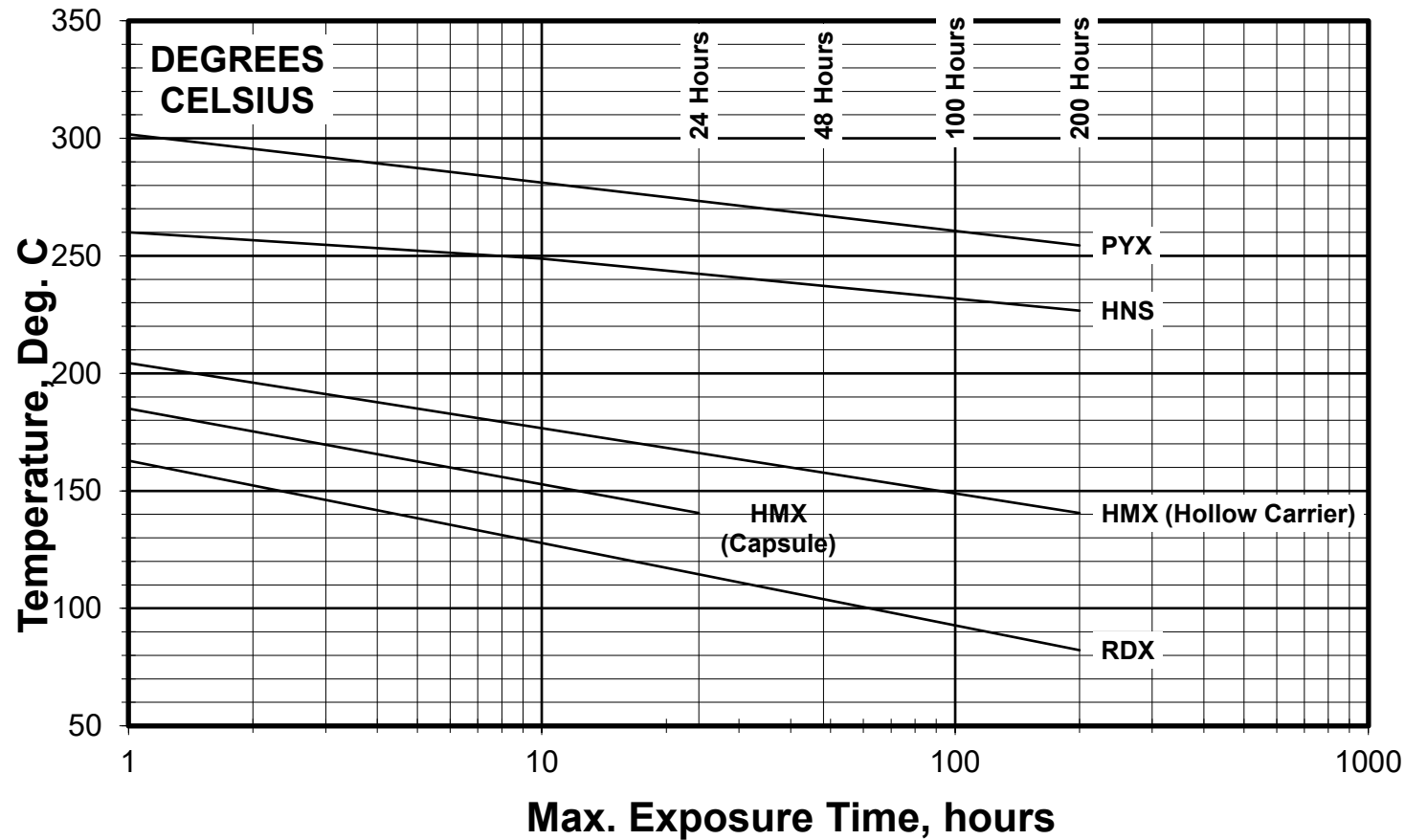
Is there a “safety margin” built into the Time / Temperature Chart?



# Time / Temperature Chart



Is there a “safety margin” built into the Time / Temperature Chart?



How often should you change out the o-rings with the perforating gun systems?

- There are many variances on the well conditions and formation
  - H<sub>2</sub>S? CO<sub>2</sub>? Both? Dry Gas Situation? Corrosive Environment?
- Rule of Thumb – Change out the O-Rings after every run!
- A \$1 or \$3 O-Ring could end up costing you thousands of \$\$ with a misrun
- In addition – be very careful when putting o-rings on the subs!

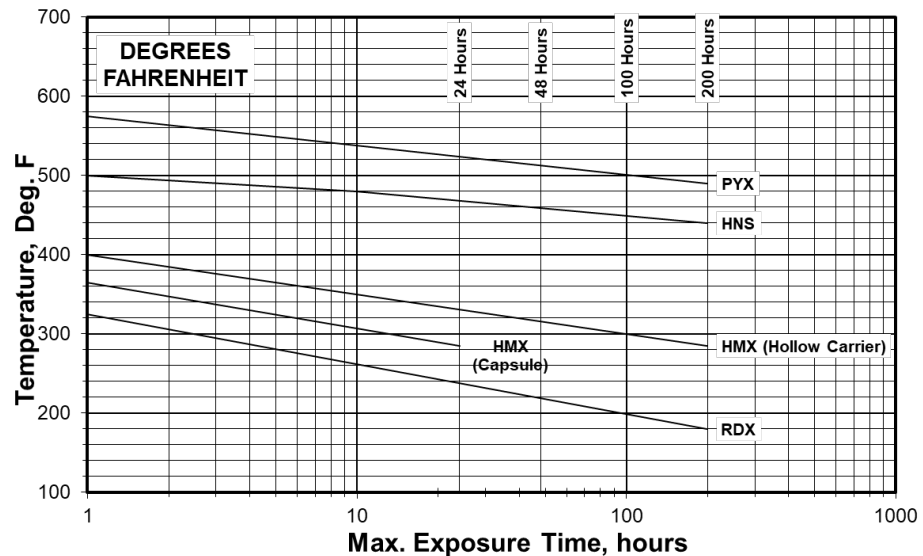


## Can you “short-stroke” a setting tool?

- Very Basic answer – YES.....
- Very Basic recommendation – NO!
- Exposing o-rings to hazardous conditions and high temperatures
  - Short-stroking only leads to a much greater chance for failure on the run
- Has this been successfully done in the past?
  - YES
  - Still – I do not recommend this
- Most all Operators require re-dressed setting tools on every run

Will shaped charges “auto-detonate” when over-exposed to bottom hole temperatures?

- Basic Answer – YES and NO!
- Refer to the Time / Temperature Chart and figure out how long the explosive was over-exposed
- Difference between Detonation and Deflagration





## Can I re-run perforating guns in the well after a mis-run or due to well conditions?

- Factors to consider:
  - New O-rings on all subs and equipment
  - Did you get “rough” when running the perforating guns in the well the first time?
  - Inspect the charge tube assembly for possible “stack-down”.
  - Was the assembly over-exposed to bottom hole temperatures?
  - Thorough investigation should take place prior to running the assembly back in the well.



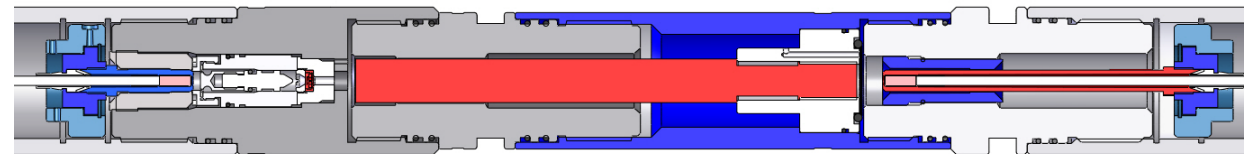
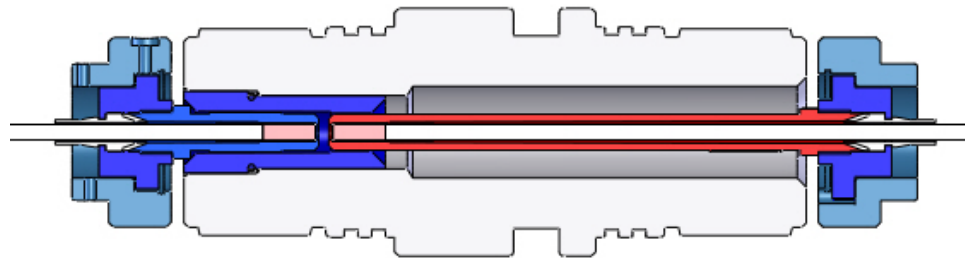
How many runs in the well can I get out of a tandem sub or window sub?

- Basic Answer – This will vary amongst manufacturers
- Items to Consider
  - Raw Material used for the subs
  - Care for the subs after each run
  - Sub Inspection with gauges
  - Exposure to corrosive environment



What is the maximum distance between boosters to successfully transfer between perforating guns?

- Manufacturer should advise on the distance between boosters on successful testing
  - Minimum testing percentage
  - Maximum distance for testing in confined area
- The same applies for distance between initiator or detonator or delay fuse
- You DO NOT want to have the boosters touching each other or compressing one another when the perforating guns are made up



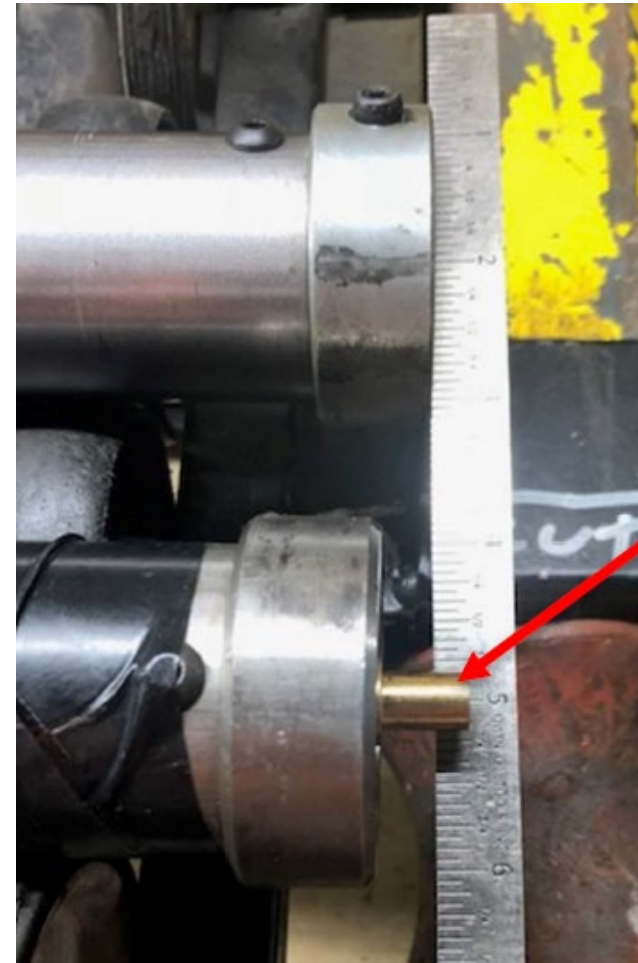
What happens to shaped charge performance when the exit hole in the perforating gun was shot out of scallop?

- Any given shot may have a 5% – 15% variance in performance based on average hole size and average penetration
- The same would apply when shooting out of scallop
  - SDP Charge or DP Charge or BH Charge or GH Charge
- Should you re-perforate the well?
  - Customer preference but I don't believe it is necessary
  - Charge being used? BH or DP
  - Depth of invade zone?
  - Many other variables
    - Shot UB or OB or EOB or DUB
    - Fracking the well?



## Example of Stackdown

- Charge tube shortens due to
  - Spudding with guns
  - Explosive force next to loaded perforating gun
  - Pulled out of rope socket and assembly fell down the well
  - Other ways
- Inspect all perforating guns
  - Booster to Booster transfers
  - Electrical connections loss
  - Shooting out of scallop





Can I Mix and Match different shaped charges from one company with perforating guns from another company?

- Company A Perforating Guns and Company B Shaped Charges
  - Even though it is done in our industry – manufacturing companies do not recommend it – liability issues
- Companies who manufacture perforating guns and shaped charges do so for testing their systems together and not with a competitor's shaped charges or perforating guns
- Liability Issues – only happens if something goes wrong, then who do you point the finger at?

## Are All Perforating Guns Rated for Dry Gas?

- Best Case Answer – NO!
- Manufacturers should advise on perforating guns rated for
  - “Shot in Fluid Only” or “Dry Gas Rated”







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# Q&A