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Supplementary information

Making bioinspired 3D-printed autonomic perspiring hydrogel actuators

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Supplementary Information

Making Bioinspired 3D Printed Autonomic Perspiring Hydrogel Actuators

Anand Kumar Mishra[a], Wenyang Pan[bc], Emmanuel P. Giannelis[c], Robert F. Shepherd[a], Thomas J. Wallin[bc*]

Affiliations:

a. Department of Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY 14850, USA

b. Facebook Reality Labs, Redmond, WA 98052, USA

c. Department of Materials Science and Engineering, Cornell University, Ithaca, NY 14850, USA

*Corresponding author

MatLab Code: Angle measurement through video and image processing

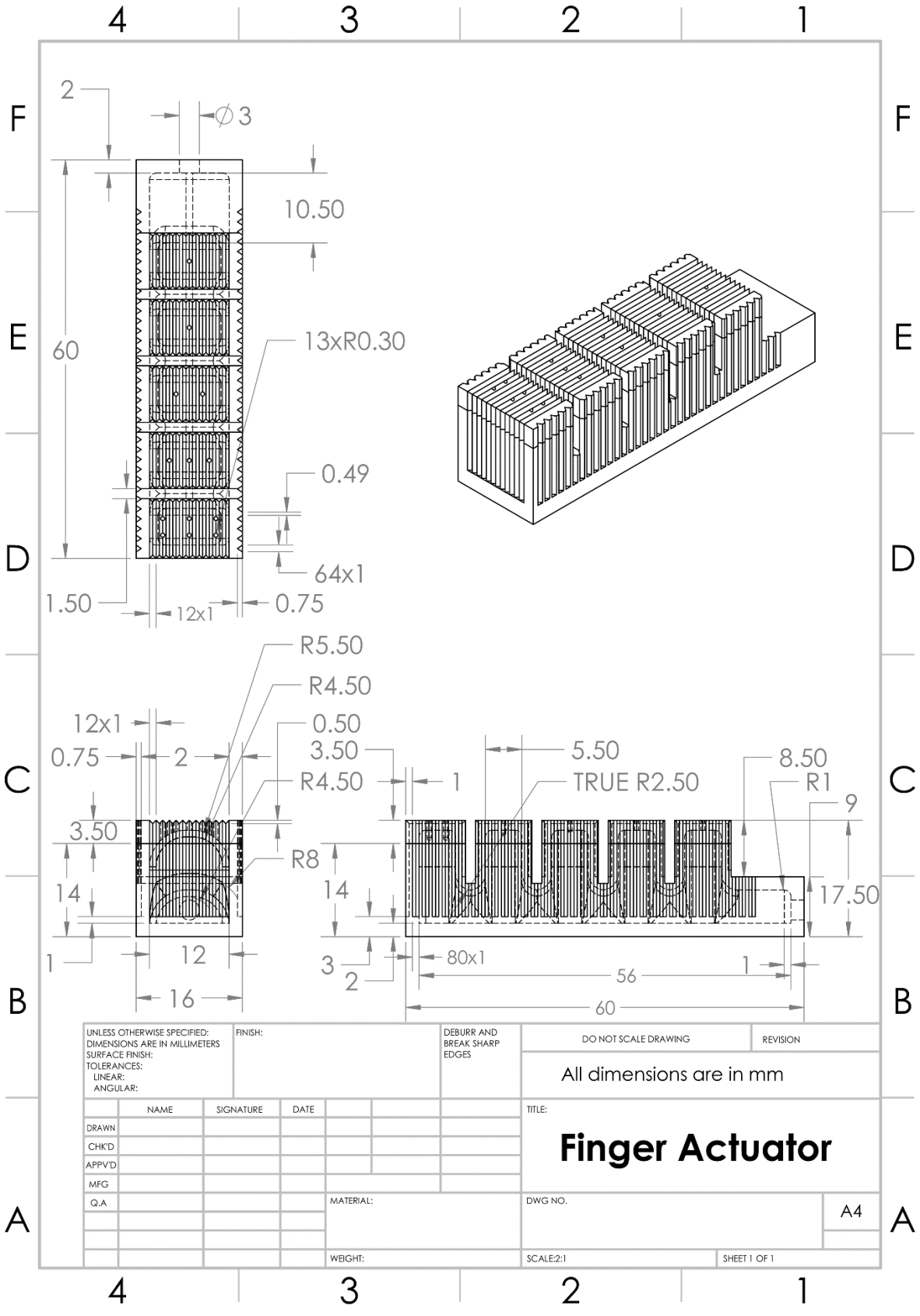
a. Video reader

```
vidObj = VideoReader('SH_A1.avi');
%  numFrames = vid.NumberOfFrames;
%  n=numFrames;
i = 0;
while hasFrame(vidObj)
    vidFrame = readFrame(vidObj);
    if(mod(i,143) == 0)
        imwrite(vidFrame,['file name' int2str(i), '.jpg']);
%  im(i)=image(vidFrame);
    end
 i=i+1;
 end
```

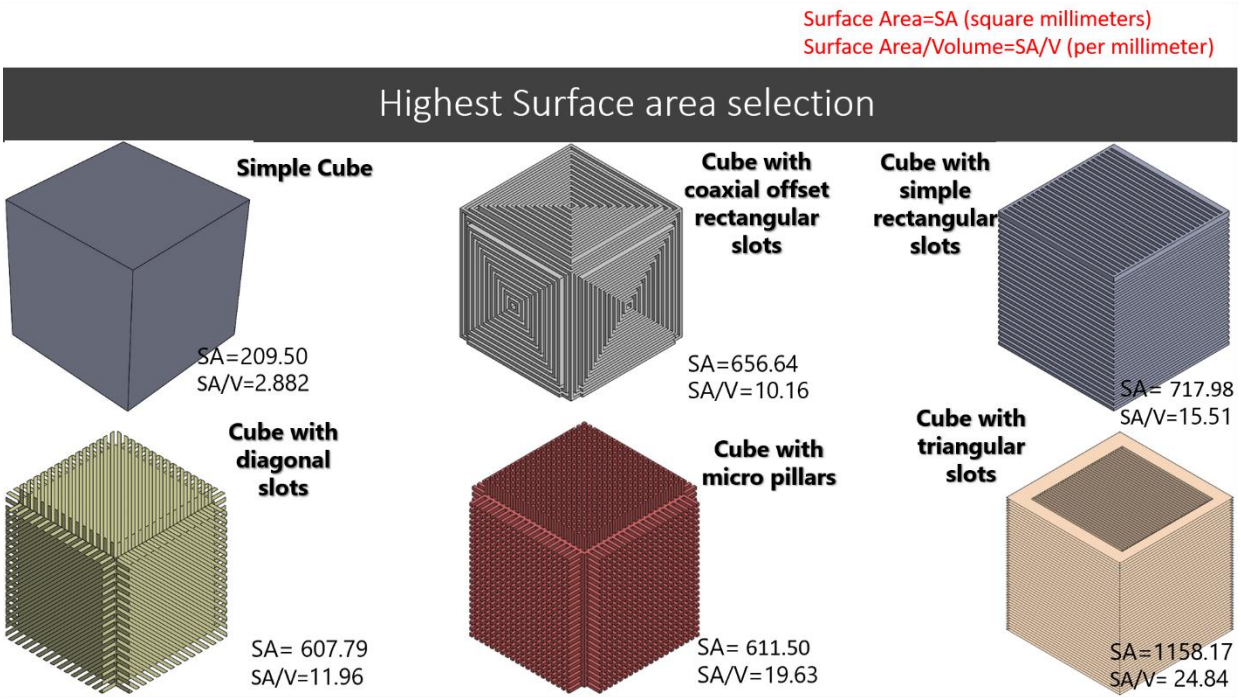
b. Angle measurement

```
dName = '';
d = dir([dName '*.jpg']);

%% REFERENCE

I = imread(fullfile(d(1).folder,d(1).name));

imshow(I);
title('Select 2 points at the base of the actutor');

[x,y] = ginput(2);
[r_curve, ~] = fit( x , y, 'poly1' );
r_p = coeffvalues(r_curve);
Angle1 = atan(r_p(1));

hold on
plot(r_curve);
hold off

pause(1);
close all;
```

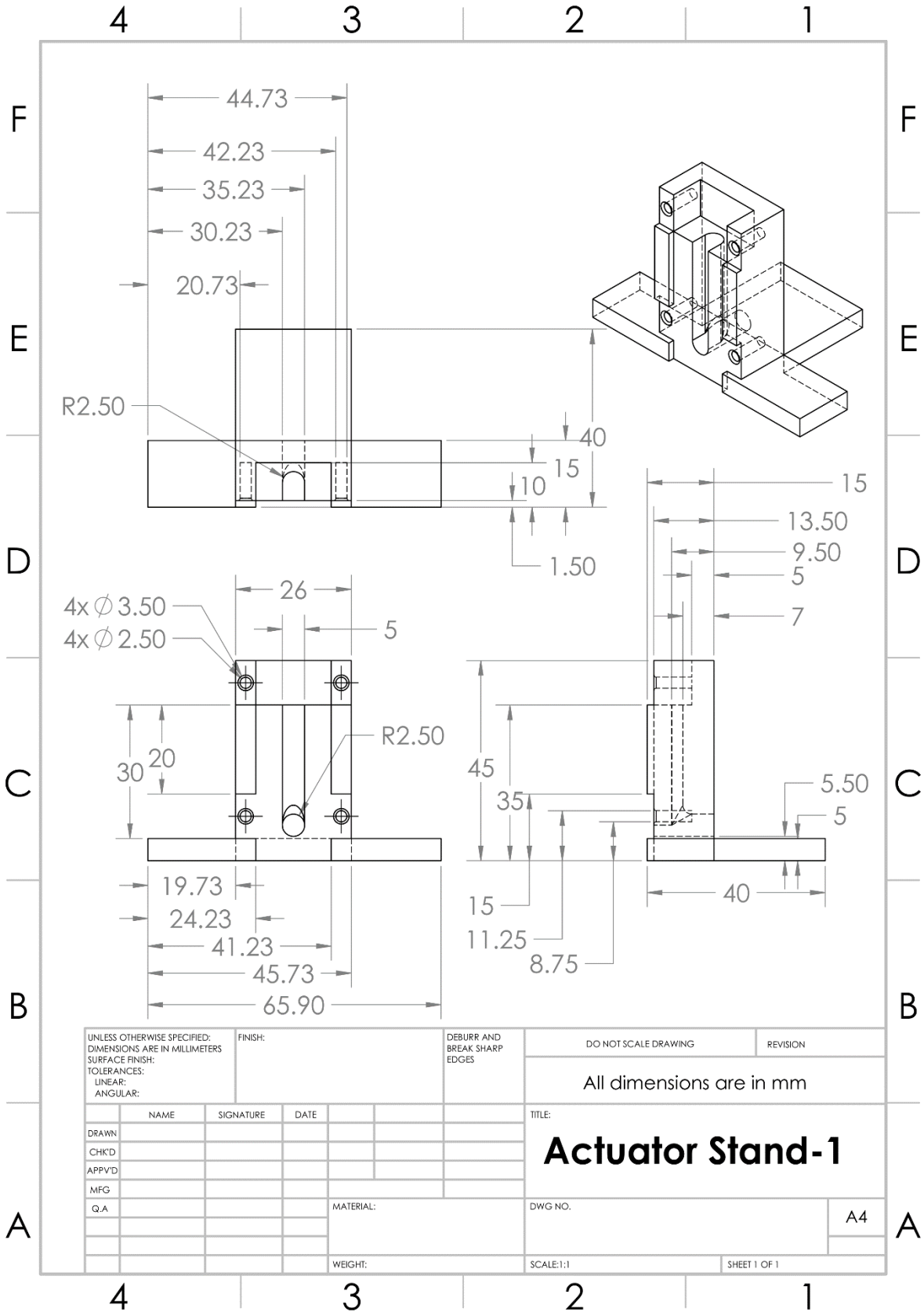
```
%%
out_agle  = nan(size(d,1));

for k = 1:size(d)
    I = imread(fullfile(d(k).folder,d(k).name));

    imshow(I);
    hold on
    plot(r_curve);

    %title('Select 2 points at the base of the actutor');

    [x,y] = ginput(2);
    [curve, ~] = fit( x , y, 'poly1' );
    p = coeffvalues(curve);
    Angle2 = atan(p(1));

    Angle2 = atan(p(1));
    Adiff = (Angle1 - Angle2) * 180/pi;
    Angle1 = atan(r_p(1));
    if(Adiff < 0)
        Adiff = abs(Adiff);
    else
        Adiff = 180 - Adiff;
    end
    out_agle(k) = Adiff;

    plot(curve);
    hold off
    title(['Angle: ' num2str(Adiff)]);
    drawnow;
end
%%
plot(out_agle);
xlabel('frame');
ylabel('Degree')
axis tight;
grid on;
```



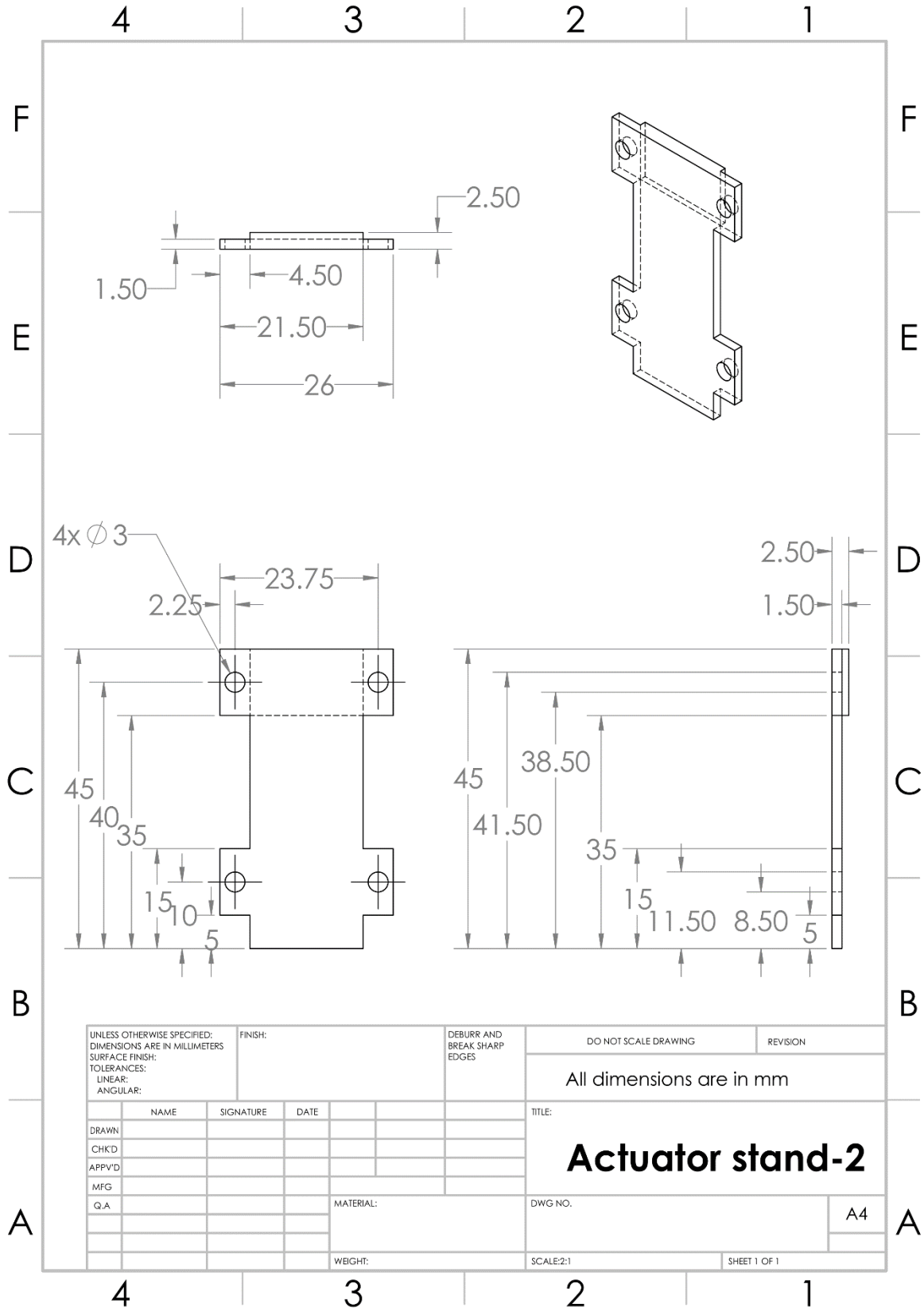
Supplementary Figure 1: Sketch drawing of finger actuator.



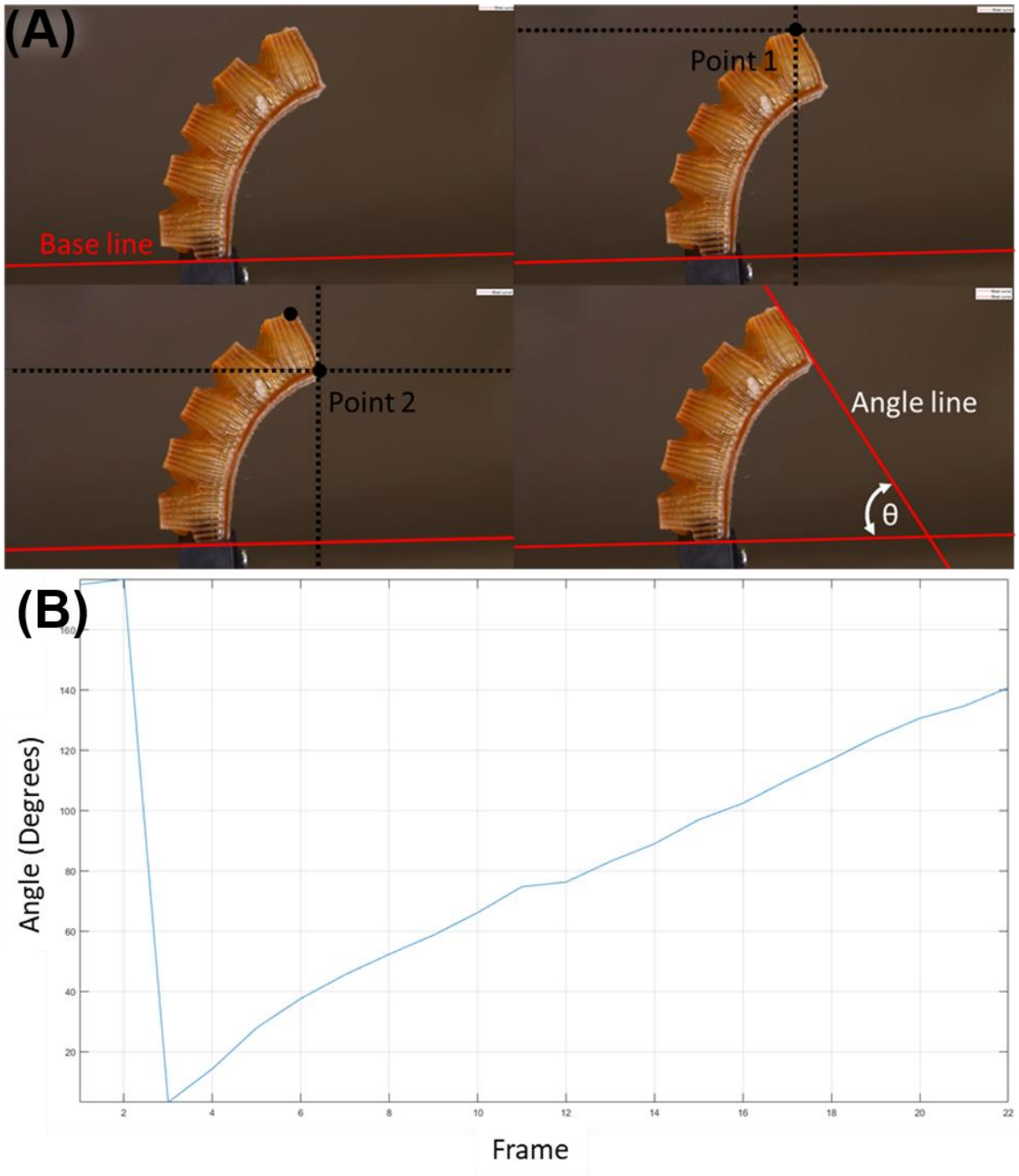
Supplementary Figure 2: Design iterations of Surface area to volume ratio (SA/V) by keeping same initial cube volume and same characteristic length of slot dimensions.



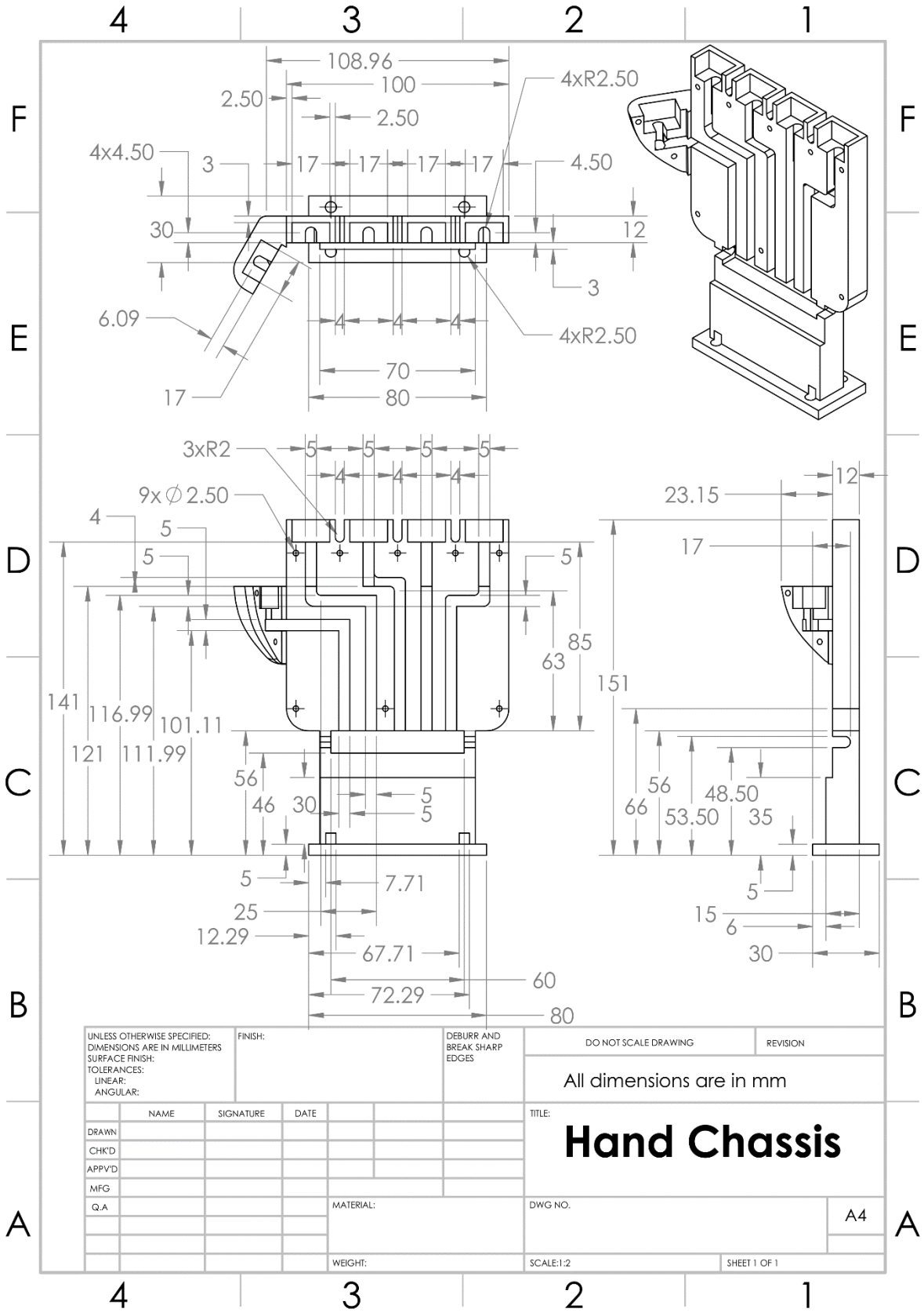
Supplementary Figure 3: Sketch drawing of single finger actuator stand.



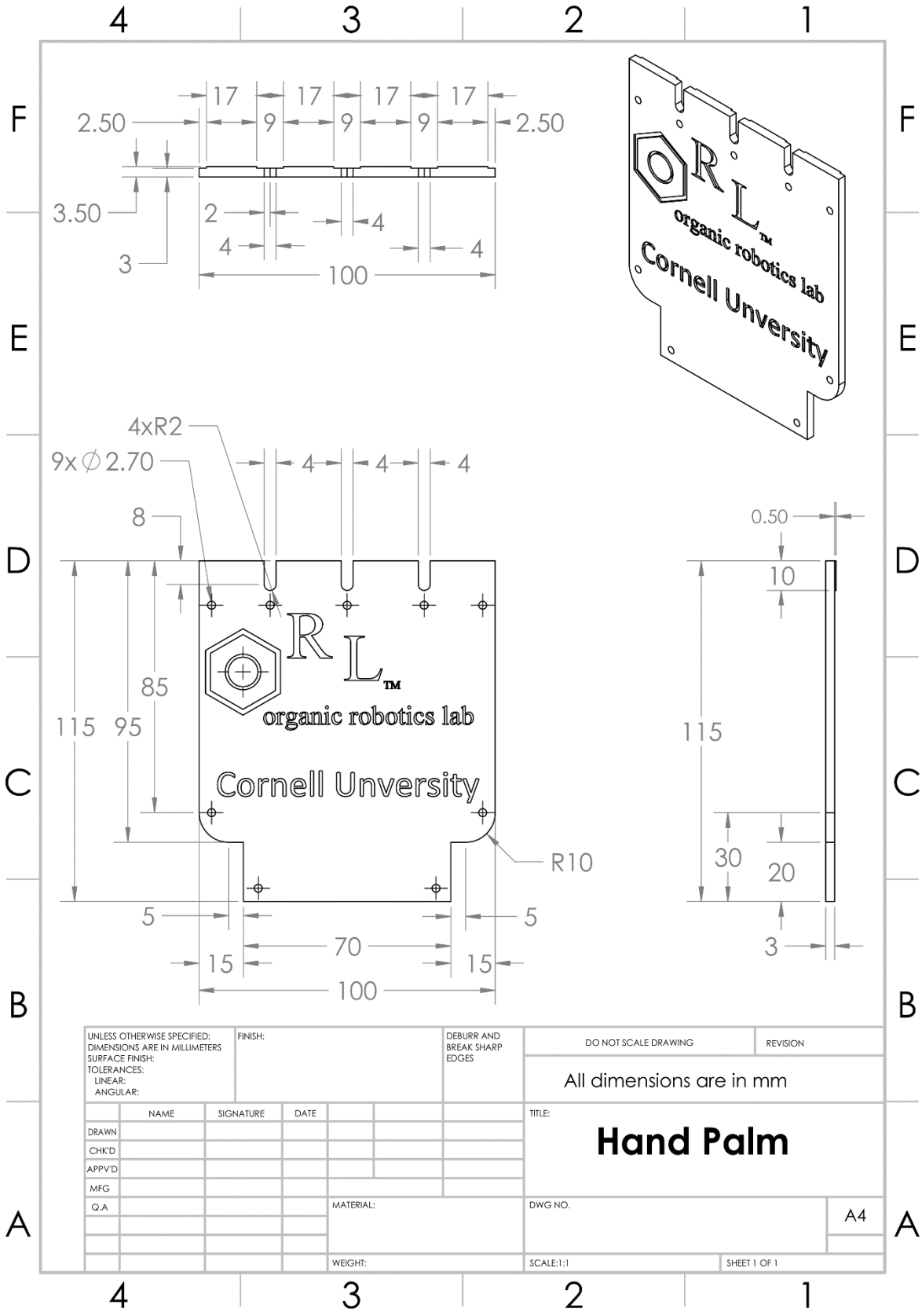
Supplementary Figure 4: Sketch drawing of single finger actuator stand cover.



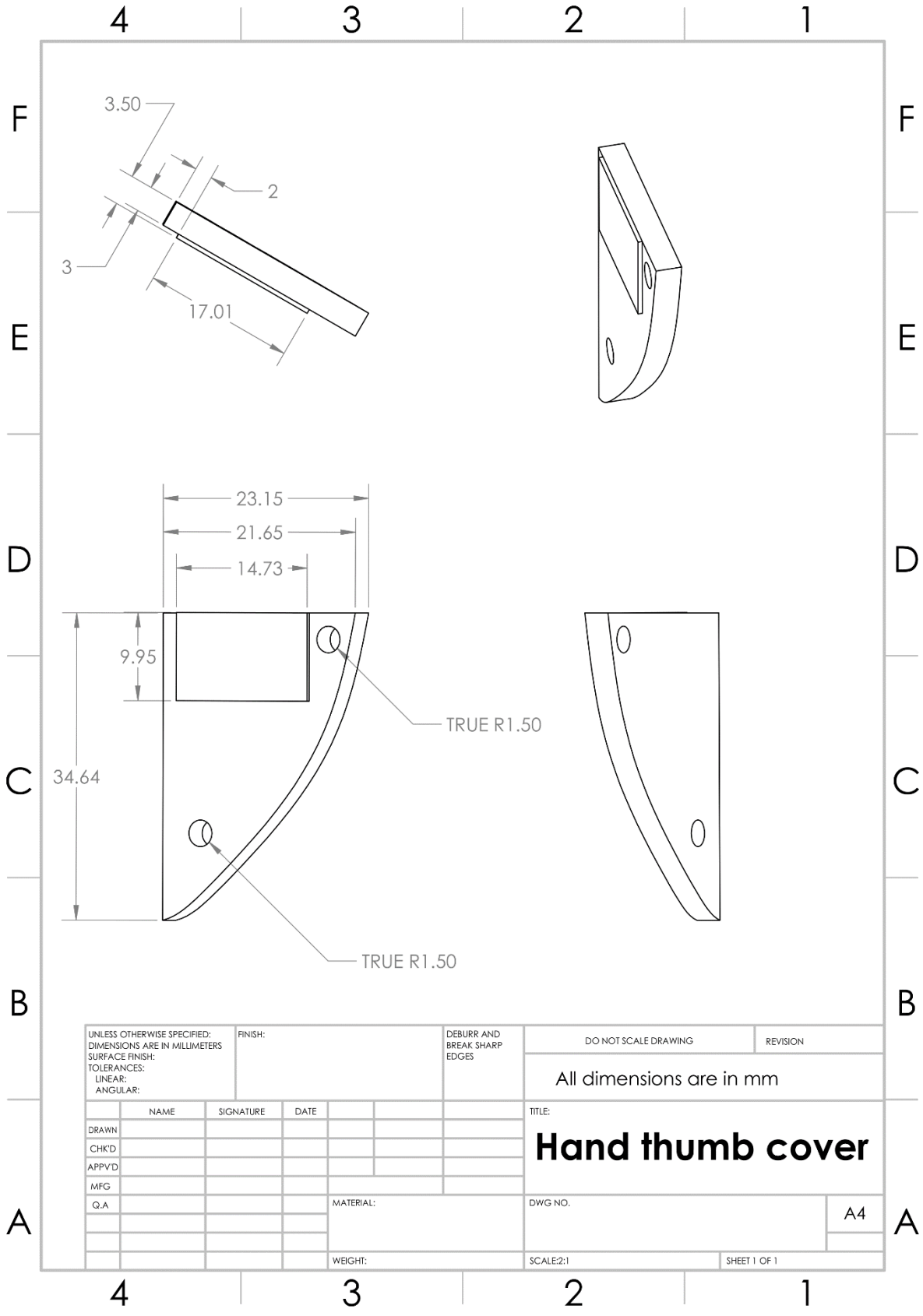
Supplementary Figure 5: Angle measurement in MATLAB. (a) Representative images with points of interest, baseline, and measured angle. (b) Measured angle as a function of image frame during measurement.



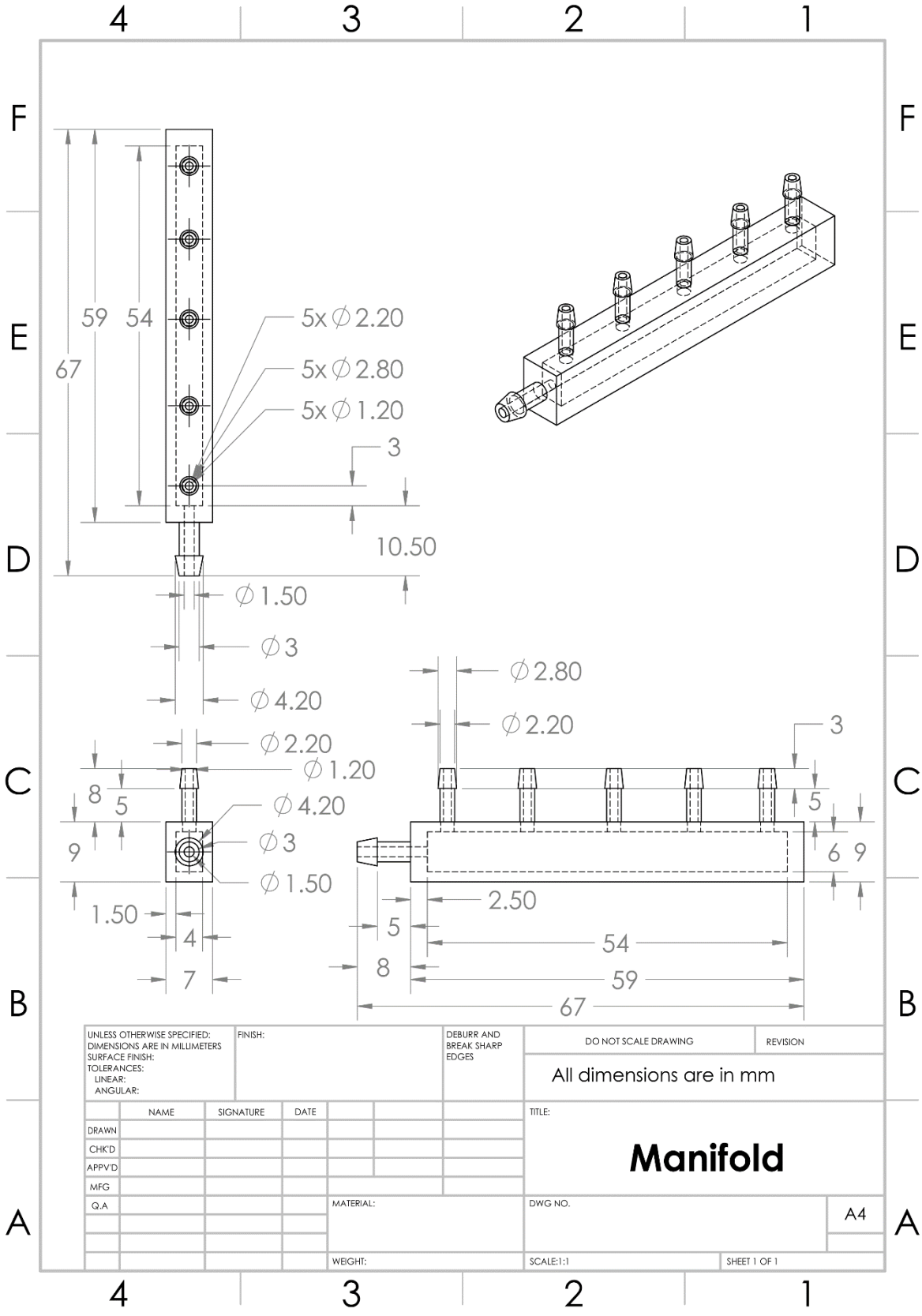
Supplementary Figure 6: Sketch drawing of sweating hand chassis.



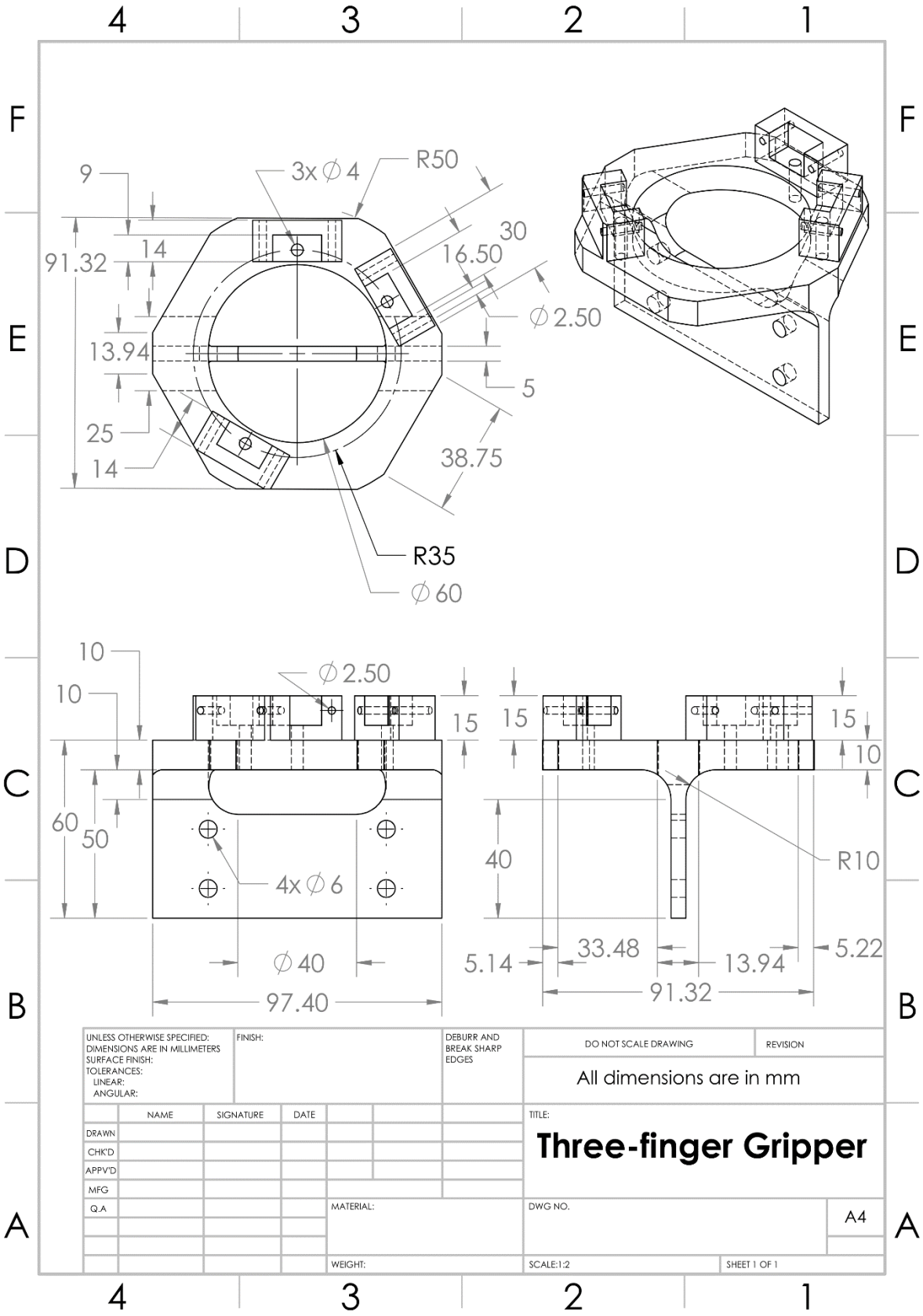
Supplementary Figure 7: Sketch drawing of sweating hand chassis cover.



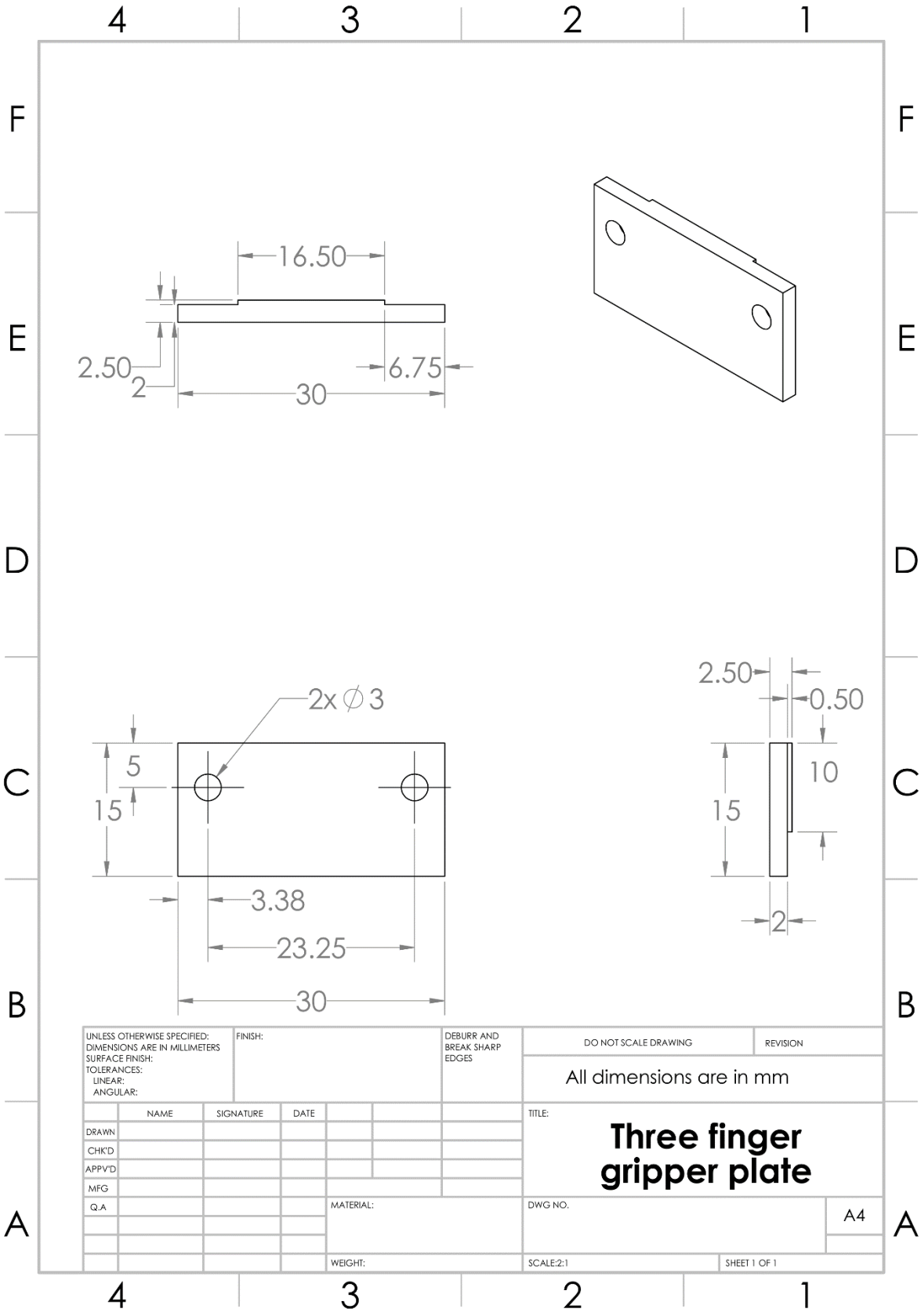
Supplementary Figure 8: Sketch drawing of sweating hand chassis thumb cover.



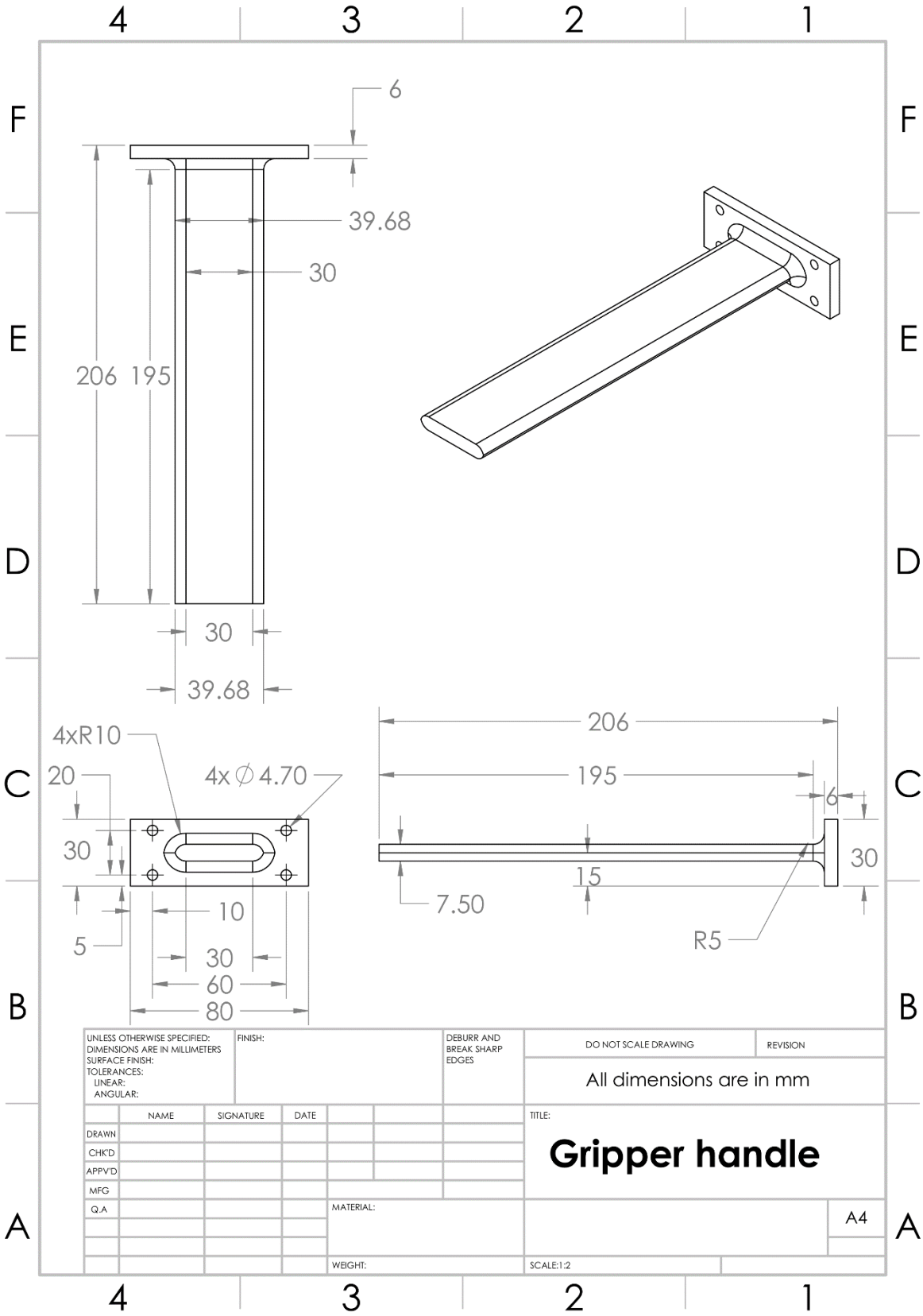
Supplementary Figure 9: Sketch drawing of sweating hand chassis manifold for tube connector.



Supplementary Figure 10: Sketch drawing of three finger gripper chassis.



Supplementary Figure 11: Sketch drawing of three finger gripper chassis cover plate.



Supplementary Figure 12: Sketch drawing of three finger gripper chassis handle.